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1997 LOWER GRANITE DAM SMOLT MONITORING PROGRAM

Annual Report 1997

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1997 LOWER GRANITE DAM
SMOLT MONITORING PROGRAM

ANNUAL REPORT

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Summary

The 1997 fish collection season at Lower Granite was characterized by high spring flows, extensive spill, cool spring and early summer water temperatures and comparatively low numbers of fish, particularly yearling chinook. A total of 4,700,325 juvenile salmonids were collected at Lower Granite this season. This is the fewest salmonids collected in the past ten years and reflects the low adult chinook escapement above Lower Granite in 1995. Of the juveniles collected, a total of 4,575,415 were transported to release sites below Bonneville Dam: 4,327,337 by barge and 248,078 by truck. An additional 116,565 fish were bypassed back to the river. A total of 95,338 salmonids were examined in daily samples. The prototype surface collector, in front of turbine units 4 through 6, was tested for the second consecutive year. The surface collector was operated from April 14 to June 1 and from July 1 to August 1.

Introduction

The Fish Passage Center's Smolt Monitoring Program is designed to provide a consistent, real-time database on fish passage and document the migrational characteristics of the many stocks of salmon and steelhead in the Columbia Basin. Each of the SMP sites collects and provides fish passage as well as pertinent flow, spill and/or other site specific data required for the SMP on a daily basis throughout the season to the FPC. FPC staff oversees and guides the SMP sampling programs at each of the sites. The Fish Passage Center, as a representative of the fishery agencies and tribes, uses this data and works with the fishery managers to seek appropriate flow and spill measures to enhance smolt passage and survival as identified in the hydrosystems operations requirements set forth in NMFS Biological Opinion and in the Northwest Power Planning Council's Fish and Wildlife Program.

Lower Granite Dam (LGR) is located on the Snake River, approximately 107.5 miles upstream from the confluence with the Columbia River. This dam is the first of eight that migratory juvenile salmonids in the Snake River and its tributaries encounter on their way to the ocean. It is one of four juvenile fish collection and transportation facilities operated by the Corps of Engineers on the Snake and Columbia Rivers. Fish are collected and either bypassed back to the river or transported in barges and trucks to release locations below Bonneville Dam. From Bonneville, the smolts complete the remaining 140-mile journey to the ocean on their own.

At Lower Granite Dam, SMP staff collect and record data by inspecting a sample of each day's total smolt collection. The SMP has been active at Lower Granite since 1984 and has been operated by the Washington State Department of Fish and Wildlife (WDFW) since 1988. Staff technicians and biologists identify and record the following information for each fish sampled: species, rearing type (hatchery or wild), freeze brands and other external marks or tags including elastomer tags, fin clips, injuries and external signs of disease and/or stress. Lengths and weights are taken on a subsample of up to one hundred fish of each species every other day. The staff also collects daily river flow and/or spill and temperature data, monitors and assists on-site research activities of other agencies as needed, maintains accurate records of sample and collection data, transmits daily reports to the FPC and prepares an annual report.

River Conditions

Flow

Average monthly river flows past Lower Granite during the 1997 smolt season, from late March through October, were the highest recorded in the last five years (Table 1). River flows for the last few days of March were near 140 kcfs (Figure 1 and Appendix A, Table 1). Flows peaked twice in April at 181.3 kcfs on April 22 and 178.4 kcfs on April 30. In May flows exceeded 150 kcfs all but 10 days with the season peak of 225.9 on May 18. Flows remained above or near 170 kcfs until late June, peaking at 193 kcfs on June 13 before dropping below 150 kcfs on June 23. River flows then declined steadily, finally dropping below 100 kcfs on July 4. Flows remained above 50 kcfs until August 13. Flows continued to decrease through the first two weeks of September to a season low of 27.2 kcfs on Sept. 12. Late September and October flow averages ranged from 34 kcfs and 48 kcfs. Daily average flows exceeded 100 kcfs for 85 days, 25 days more than last year. Daily average flows exceeded 150 kcfs on 53 days and 200 kcfs on six days this season.

Spill

Spill occurred for 119 days from the end of March through early July and peaked at 103.2 kcfs (45.7% of total flow) on May 18 (Table 1, Figure 1 and Appendix A, Table 1). Flows in excess of turbine capacity provided 24 hour per day spill for 65 days between April 21 and June 25. Spill for fish passage occurred primarily in early April and late June. Spill for fish passage occurred between the hours of midnight and noon to accommodate surface collector testing. Surface-collector discharge, between 4.3 and 6.2 kcfs, through spillbays one and two occurred nearly continuously when the surface collector was operated, from April 14 through the end of May and most of July.

Water temperature

Overall, water temperatures this season were very similar to last year. Water temperatures measured in the sample tank at Lower Granite Dam at the start of the season in late March were near 46º F and remained below 60º F until June 21 (Appendix 1 Table 1). The water temperature did not reach 65º F until July 11, 70º F until August 23 and peaked at 71.6º F on Sept. 4. Temperatures fell below 70º F Sept. 20 and dropped to 60º F by Oct. 13. The temperature at the end of the season was 57º F.

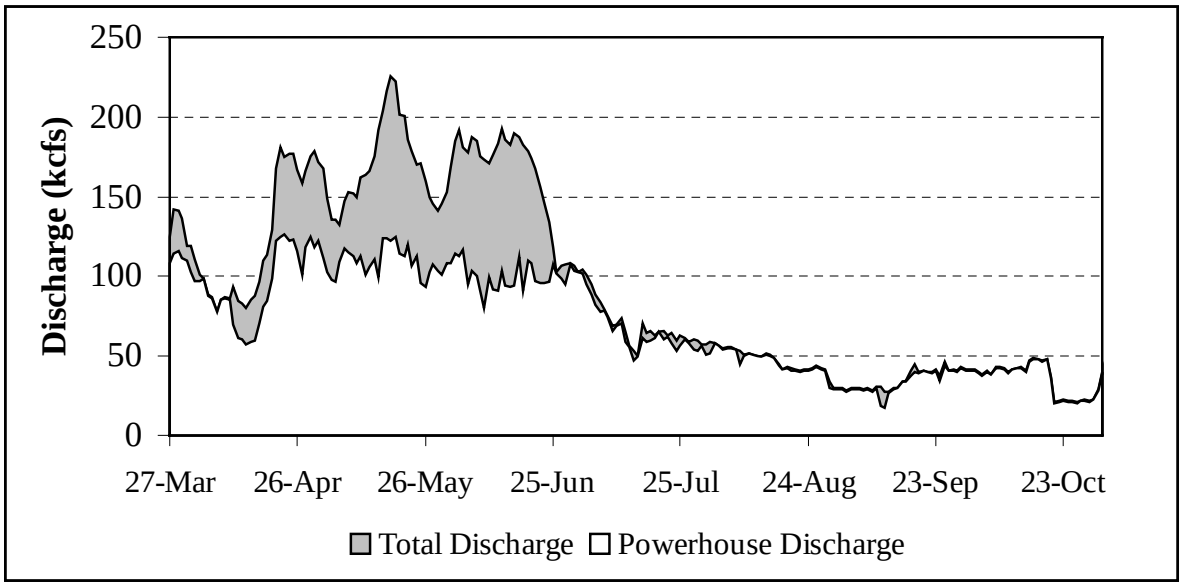
From April through October temperature units (tu's), the number of Fahrenheit degrees above 32º F, were about the same as in 1996, 6,025 temperature units versus 5,922. Water temperatures during the spring/summer migration period, April 1 to June 20, were slightly warmer as measured based on the number of tu's recorded, 1,631 versus 1,579 tu's in 1996. Water temperatures were slightly warmer throughout the summer/fall migration period, June 21 and Nov. 1, than in 1996. A total of 4,446 tu's were recorded during the summer/fall migration period compared with 4,291 in 1996. Most of the difference was reflected in higher average water temperatures for five weeks from late August through September, 69º F this season compared with 64º F in 1996.

Table 1. Comparison of average monthly river flow and spill at Lower Granite Dam, 1993-1997.

Month	1993	1994	1995	1996	1997	1993-1997 Average
			Flow (kcfs)			
Apr	63.9	51.0	60.1	112.6	120.9	81.2
May	130.5	77.5	107.9	126.2	168.5	122.1
Jun	100.4	39.3	115.6	146.2	162.8	112.9
Jul	50.7	39.4	62.0	55.4	69.8	55.4
Aug	33.4	13.0	37.4	37.6	46.9	33.7
Sep	20.5	13.4	27.4	25.0	29.6	23.2
Oct	23.6	17.5	28.0	22.2	40.5	26.3
			Spill (kcfs)			
Apr	0.0	0.0	0.0	47.0	27.2	14.8
May	26.1	15.7	18.4	47.0	58.5	33.2
Jun	1.2	7.9	9.3	52.6	62.1	28.3
Jul	0.0	0.0	0.0	3.4	3.3	1.3
Aug	0.0	0.0	0.0	0.1[1]	0.6	0.9
Sep	0.0	0.0	0.0	0.0	1.5	0.3
Oct	0.0	0.0	0.0	0.0	0.2	0.0

[1]Spill done at the request of BPA.

Figure 1. Daily Average Total and Powerhouse Discharge at Lower Granite Dam, 1997. Note: the difference between total discharge and powerhouse discharge is spill discharge (gray area).



Debris

Debris presented a significant challenge throughout this season. Beginning with the late winter precipitation and snow melt, large numbers of trees, branches, sticks and weeds showed up in the forebay. Prior to the start of the collection season this debris covered up to 80 surface acres and extended across the front of the dam. Although most of this debris was removed by the time the fish passage season started, some of it was isolated to the north side of the navigation lock and remained in the water all season. High spring flows during April and May brought more debris down river. Trash racks were first cleaned of debris in late March and early April when the fish guiding screens were installed. The shear boom, which keeps debris away from the turbines, also developed problems during the spring and summer migration period, with several of the sections coming loose at one end. This let considerable debris inside the boom, most of which collected in front of turbine units 1, 2 and 3, causing equipment to breakdown. This debris was finally removed in October. The Corps was not able rake the trash racks again until early August at which time they removed nearly a truckload of debris from each trash rack. Frequent equipment breakdowns occurred as did staff shortages as Corps staff tried to keep up with the debris workload.

Sample Program and Summary

Overview

During the collection season at Lower Granite Dam, we sampled fish daily from March 27 through Nov. 1. A percentage of the total number of fish collected were automatically diverted into the sample tank by a pair of timer-controlled slide gates. The slide gates were set to automatically open and shut the gates six times per hour to achieve the desired sample rate. The sample rate was adjusted during the season by the COE project biologist based on the Sample Rates Guideline Table (Table 2), on daily trends in total collection estimates, and at the request of SMP staff to meet sample needs. For the most part, we were able to meet the sample rate guidelines this season. We did not need to increase the sample rates above the guidelines this year to assist National Marine Fisheries Service marking activities in the sample lab as we did in 1995 and 1996.

As in 1996, we conducted Gas Bubble Trauma (GBT) sampling at the dam. Sample fish were netted directly off of the separator between early April and the end of June (see research section of this report for details). To prevent these fish from subsequently being re-sampled, anesthetized and handled twice, these fish were released directly into a raceway instead of back into the separator. These fish were recorded as sampled at a rate of 100% and the numbers added to the following day's total collection.

Daily sample procedure

Fish diverted to the sample tank were held for up to 24 hours prior to examination. The 24-hour sample period started at 7 a.m. At the end of the 24-hour sampling period, the entire sample was processed batch by batch. The batches were separated as follows: screens in the sample holding tank were moved forward to crowd fish to the front of the tank. Once there, batches of fish were drawn/guided into the pre-anesthetic chambers by opening and closing the knife gates. Batch sizes typically ranged between 30 and 60 fish per chamber and the number of fish was adjusted based on the amount of time the gate was opened and the position of the crowder screen. The fish tranquilizer, ethyl *m*-aminobenzoate methansulfonate (MS-222®), was added to the chamber to obtain a concentration of about 62 mg/l. At this concentration, about 95 percent of the fish were adequately sedated within three minutes. Once anesthetized, these fish are flushed through the exit valve on down to the sorting tank.

The sorting tank is part of a re-circulating anesthetic system with water temperature control and aeration. The anesthetic levels in the system are set to keep fish sedated and easy to handle during the sample. Typically the MS-222 levels averaged between 55-60 mg/L. Sample fish remained in the sorting tank for as little as five seconds and up to five minutes. We strive to process fish within three minutes of entering the tank to minimize the effects of sedation and handling as much as possible. Between the pre-anesthetic chambers and the sorting tank, sample fish were sedated an average of five minutes.

All fish handled in the sorting tank were enumerated by species and examined for unique marks and descaling. Additionally, a detailed sub-sample of up to 100 fish of each species was conducted during each daily sample. The detailed sub-sample recorded species, length, weight, unique marks, descaling, injuries and external symptoms of disease. In this process, fish were individually weighed and measured in a water-filled tray on an electronic balance. This detailed sub-sample provides the Corps with fish per pound and species composition data essential for the Corps biologist to calculate raceway, barge and truck loading densities and stay within the maximum loading densities of 0.5 pounds of fish for every gallon of water.

Immediately after handling, fish were routed in fresh water to the recovery tank on non-transport days or routed directly onto a waiting truck or barge on transport days. The maximum time that any fish was held at the fish facility was 48 hours.

Season sample summary

This year's collection season started on March 26 and the first daily sample was processed on March 27. The daily sample period began at 7 a.m. and ended at 7 a.m. the next day. Smolts were sampled daily at the end of the 24-hour sample period through most of the season. In August, after collection totals dropped to less than five hundred fish for five consecutive days, fish were sampled every other day to accommodate the Corps' transport schedule with the mini-tanker. The mini-tanker, a 150-gallon temperature controlled tank in the back of a heavy duty pickup truck, could only be loaded from the sample. Though we sampled every other day, the fish were still collected on a daily basis. A total of 220 daily samples were processed between March 26 and Nov. 1.

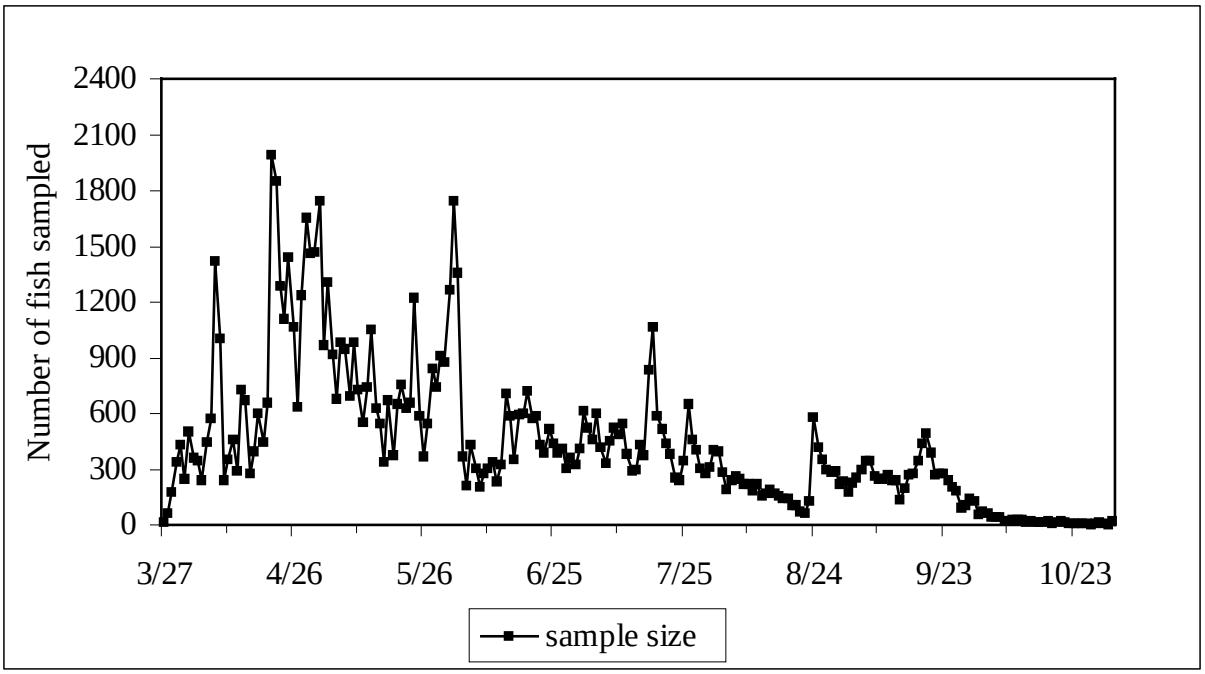
Collection totals of fish entering the fish facility were used to determine sample rates based on the sample rate guideline table (Table 2) provided by FPC. Daily sample rates throughout the season were adjusted, when practical, to achieve daily sample sizes of between 500 and 800 smolts. When the daily total collection exceeded the minimum sample rate setting of 0.0067 (0.67%) sample sizes ranged from 800 to nearly 2000. This season daily collection totals exceeded 80,000 for twenty-one days from April 20 to May 10. Also, sample sizes exceeded guideline criteria on isolated days when incoming fish numbers increased unexpectedly (Figure 2). Sample rates prior to daily peak collection numbers were typically less than the recommended guidelines and afterwards, slightly higher.

Table 2: Sample rate guideline table.

Daily Collection	Sample Rate	Number of fish in sample
>80,000	0.67%	536 - 1,741[1]
60,000 - 80,000	1.00%	600 - 8,00
40,000 - 59,999	1.33%	532 - 800
25,000 - 39,999	2.00%	500 - 780
15,000 - 24,999	3.33%	500 - 832
10,000 - 14,999	5.00%	500 - 750
7,500 - 9,999	6.67%	500 - 667
5,000 - 7,499	10.00%	500 - 750
2,500 - 4,999	16.67%	417 - 833
500 – 2,499	25.00%	125 - 625
<500	100.00%	ALL

[1] peak collection day May 2.

Figure 2: Daily sample totals and percent of collection sampled, 1997



We sampled 95,338 smolts, 2.0% of the total collection this season (Table 3). This is about 6,500 fewer smolts than we sampled last season. In terms of actual collection numbers this season the totals for all species except wild subyearling fall chinook declined from the previous years (Table 15). This year's collection of less than fifty-seven thousand wild yearling chinook is the lowest total recorded since 1993 when we could first identify and separate hatchery and wild yearling chinook in the daily samples. The percent sampled for each species also decreased this year because hatchery subyearling chinook were included in the sample calculations. In 1996, hatchery subyearling chinook were 100% PIT-tagged and PIT-tag slidegates were set to override the sample for bypass. This year, untagged hatchery subyearling chinook accounted for 20.7% of the season sample total (Table 4). Wild subyearling chinook accounted for 7.0% of this season's total sample and 6.6% last year. The percentage of hatchery and wild yearling chinook in the sample decreased from 6.6% and 3.1% last year to 3.1% and 1.0% this year. Hatchery and wild steelhead accounted for 62.5% and 5.2% of all fish sampled this year compared to 72.7% and 8.1% in 1996. Hatchery and wild sockeye/kokanee, both less than 0.1% in 1996, each accounted for 0.2% this year. Hatchery coho decreased from 1.6% in 1996 to 0.1% this year.

Table 3. Annual percent sampled of juvenile salmonids collected at Lower Granite Dam, 1993-1997.

	Yearling Chinook		Subyearling[1] Chinook		Steelhead		Sockeye/Kokanee[2]		Coho[3]	
Year	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Total
1993	2.8	1.6	---	72.3	15.1	2.0	---	1.8	---	1.9
1994	1.4	3.5	---	36.9	2.1	2.2	---	6.3	---	2.0
1995	1.0	2.4	---	28.7	1.0	1.3	10.0	9.8	---	1.2
1996	1.5	2.5	---	38.5	1.7	2.6	7.4	9.7	8.4	1.9
1997	1.3	1.7	26.9	38.3	1.5	1.6	7.1	36.3	6.9	2.0

[1]Hatchery subyearling chinook were not present until 1997.
[2]Hatchery sockeye/kokanee were not present until 1995.
[3]Hatchery coho were not present until 1996.

Table 4. Weekly average sample rates and weekly sample totals by species at Lower Granite Dam, 1997.

Week Ending	Weekly Rate (%)[1]	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
		Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Totals
Apr 03	8.57	1	36	0	0	1,216	882	0	4	0	2,139
Apr 10	3.17	11	123	0	5	3,628	486	0	1	0	4,254
Apr 17	2.00	54	177	0	0	2,748	189	0	2	0	3,170
Apr 24	1.30	862	242	0	0	5,834	994	0	6	0	7,938
May 01	0.92	397	109	0	1	7,917	529	0	4	0	8,957
May 08	0.67	284	24	0	0	7,000	227	0	1	0	7,536
May 15	0.67	259	37	0	0	4,654	417	0	2	0	5,369
May 22	1.17	270	31	0	6	3,380	272	0	3	4	3,966
May 29	2.47	149	21	0	4	4,585	187	0	5	3	4,954
Jun 05	4.88	230	35	0	4	6,149	279	0	6	26	6,729
Jun 12	6.83	109	25	0	4	1849	88	0	2	17	2,094
Jun 19	15.53	176	57	262	57	3,214	87	0	10	20	3,883
Jun 26	16.47	97	17	726	215	2,128	80	0	40	14	3,317
Jul 03	16.38	48	5	1,107	270	1,452	26	0	30	8	2,946
Jul 10	16.67	18	1	1,485	310	1,396	15	4	16	12	3,257
Jul 17	20.16	2	6	2,083	392	636	9	9	11	3	3,151
Jul 24	18.56	7	0	2,458	384	591	27	9	12	0	3,488
Jul 31	25.00	0	1	2,195	224	298	1	28	4	0	2,751
Aug 07	25.00	1	0	1,613	180	188	16	13	6	0	2,017
Aug 14	25.00	0	0	1,035	152	163	3	9	1	0	1,363
Aug 21	25.00	0	0	572	129	164	14	7	2	0	888
Aug 28	78.22	0	0	1,510	381	192	17	10	12	0	2,122
Sep 04	100.00	0	0	1,190	426	63	12	6	4	0	1,701
Sep 11	100.00	0	1	1,136	745	52	15	6	4	0	1,959
Sep 18	100.00	0	3	887	978	26	2	4	5	0	1,905
Sep 25	100.00	0	0	866	1,225	30	13	6	2	0	2,142
Oct 02	100.00	0	0	350	384	14	18	17	3	0	786
Oct 09	100.00	0	0	130	114	3	4	6	3	0	260
Oct 16	100.00	0	0	73	49	6	0	8	1	0	137
Oct 23	100.00	0	0	42	35	6	5	3	0	0	91
Oct 30	100.00	0	0	20	12	3	3	2	1	0	41
Nov 01	100.00	0	0	6	14	2	2	2	1	0	27
Total Sampled		2,975	951	19,746	6,700	59,587	4,919	149	204	107	95,338
% of Sample		3.1	1.0	20.7	7.0	62.5	5.2	0.2	0.2	0.1	100.0
% of Collection		1.3	1.7	26.9	38.3	1.5	1.6	36.3	6.9	7.1	2.0

[1] Fish sampled/fish collected X 100%.

Mark recaptures

Project staff observed and recorded freeze brand marks on steelhead and elastomer (EL) visual implant tags on chinook this season. The elastomer visual implant tags were colored and located in the clear adipose tissue behind the eye. For each marked smolt observed, we recorded species, mark (type, location and color as needed), and fork length. A total of 1,079 marked fish were observed and tallied from the daily samples this season. When expanded to account for daily sample rates, an estimated total of 75,360 marked fish entered the collection facility this season.

According to FPC mark release information, four agencies released brand and elastomer marked fish above Lower Granite Dam: USFWS, WDFW, IDFG and the Nez Perce Tribe. Together, they released a total of 80,000 hatchery steelhead with freeze brands and 63,375 yearling summer and 346,000 yearling fall chinook with elastomer tags.

Five groups of branded hatchery steelhead were released from two different sites upstream of LGR (Table 5). Forty thousand branded Lyons Ferry Hatchery steelhead were released by WDFW at Cottonwood Ponds on the Grande Ronde River. Nearly ten thousand, 24.1%, of these fish entered the collection facility at Lower Granite. These steelhead were released between March 25 and April 30. By April 30, approximately 75% of them had reached and/or passed LGR (Table 6). From April 28 through May 2, four groups of 10,000 steelhead from Dworshak Hatchery were released on the North Fork of the Clearwater River. The estimated percentages that reached LGR for these groups ranged from 0.5% to 41.6%. In three of the five marked groups 75% of the steelhead were observed at LGR within a ten day period. Most of the steelhead in the group with the RD-R-2 brand took almost a monthe to pass LGR.

Four groups of hatchery yearling chinook with color-coded elastomer (EL) tags were released from several sites upstream of LGR (Table 5). IDFG's McCall summer chinook, marked with red elastomer tags, originated furthest from LGR at their release site in the South Fork of the Salmon River. An estimated total of 1,050, 1.7%, of these fish entered the collection facility. The three Nez Perce Tribe releases of yearling fall chinook, reared at Lyons Ferry Hatchery, were marked with green and blue EL tags. Between 15 and 17 percent of these fish entered the collection facility. The left green EL fish were released on the Clearwater River and the right green EL fish were released at Pittsburgh Landing on the Snake River on April 14. Chinook released at Pittsburgh Landing were seen in Lower Granite's sample tank within two days of release (Table 6). Fall chinook with the left blue elastomer were released in the Clearwater River on May 14 and were seen in daily samples within four days. IDFG's right red EL summer chinook released on March 19 were first observed thirty-six days later on April 24.

Table 5. Number of hatchery steelhead and chinook marked and released above LGR and the estimated total numbers and percent of each marked group entering the LGR collection facility (recaptured) in 1997.

Mark Code[1]	Rearing type & Species	Race	Hatchery	Release Site	RKm To LGR	Total Released	Total Recaptured	Percent Recovered
FB-RA-IL-3	H. Steelhead	SU	Lyons Ferry	Cottonwood Grand Ronde R	82	40,000	9,650	24.1%
FB-LA-R-1	H. Steelhead	SU	Dworshak	N.F. Clearwater R.	116	10,000	2,306	23.1%
FB-LD-R-4	H. Steelhead	SU	Dworshak	N.F. Clearwater R.	116	10,000	50	0.5%
FB-RA-R-4	H. Steelhead	SU	Dworshak	N.F. Clearwater R.	116	10,000	4,156	41.6%
FB-RD-R-2	H. Steelhead	SU	Dworshak	N.F. Clearwater R.	116	10,000	626	6.3%
EL-RRE	H. Chinook	SU	McCall	S.F. Salmon R.	345	63,375	1,050	1.7%
EL-RGR	H. Chinook	FA	Lyons Ferry	Clearwater River	51	148,000	22,940	15.5%
EL-LGR	H. Chinook	FA	Lyons Ferry	Pittsburgh L. Snake R.	51	148,000	26,173	17.7%
EL-LBL	H. Chinook	FA	Lyons Ferry	Clearwater River	51	50,000	8,409	16.8%

[1]Mark Codes: FB = freeze brands (location, brand, orientation); EL = elastomer tags (side, color).

Table 6. Passage dates of marked hatchery steelhead and chinook collected at Lower Granite Dam in 1997.

Mark Code	Rearing type & Species	Race	Release Date	First Observed	25%	50%	75%	Last Observed
FB-RA-IL-3	H. Steelhead	SU	Mar 25	Apr 21	Apr 28	Apr 29	Apr 30	May 22
FB-LA-R-1	H. Steelhead	SU	Apr 28	May 4	May 5	May 7	May 10	Jun 23
FB-LD-R-4	H. Steelhead	SU	Apr 28	May 24	---	---	---	May 24
FB-RA-R-4	H. Steelhead	SU	Apr 28	Apr 30	---	May 1	May 2	Jun 25
FB-RD-R-2	H. Steelhead	SU	Apr 28	May 4	May 4	May 5	May 30	Jun 23
EL-RRE	H. Chinook	SU	Mar 19	Apr 24	May 1	May 11	May 15	May 19
EL-RGR	H. Chinook	FA	Apr 14	Apr 18	Apr 21	Apr 22	Apr 28	Jun 2
EL-LGR	H. Chinook	FA	Apr 14	Apr 18	Apr 23	May 2	May 9	Jul 6
EL-LBL	H. Chinook	FA	May 14	May 16	May 18	May 19	May 27	Jul 8

[1]Mark Codes: FB = freeze brands (location, brand, orientation); EL = elastomer tags (side, color).

Sample procedures for Gas Bubble Trauma (GBT)

Sampling methods to identify levels of dissolved gas in juvenile salmonids have undergone continuous review since the program started in 1994. Current sampling methods and protocol are based on research conducted by fish physiologists and health specialists/pathologists with the United States Geological Survey, Biological Research Division (BRD) based at the Columbia River lab at Cook, WA. Fish Passage Center staff have actively guided and participated in this process. BRD staff have conducted training sessions at the beginning of each season for the past four years. Staff from Lower Granite Dam attended this season's GBT training seminar at the Cook lab on March 26 and 27 where fish handling methods, examination techniques, and data handling protocols were reviewed and demonstrated. Site specific sample protocols at Lower Granite called for us to examine 100 yearling chinook and 100 steelhead, hatchery or wild, every other day, Monday, Wednesday and Friday between April and June.

Fish for GBT samples were netted from the open flume just ahead of the separator bars where fish would be diverted to the raceways or sample tank via sample gates and flumes. Staff would net and collect fish, individually, either steelhead or chinook, and place them in a dark, five-gallon bucket with 10 liters of water with MS-222® at 30mg/l. Once they had collected seven fish they would carry the bucket and fish downstairs to the GBT lab located next to the separator. The time required to net seven fish varied due to fish availability but generally took about five minutes. In the GBT lab, one fish at a time would be removed from the capture bucket, scanned for the presence of a PIT tag. If a tag was detected, the code was recorded and this fish returned to a bucket containing fresh water. The tagged fish was allowed to recover and released back into the separator. Later all PIT tag codes were entered into a PTAGIS recapture file. If no PIT tag was detected the fish was placed in a bucket with water and MS-222® at 80 mg/l to fully sedate the fish for the detailed examination. Once fully sedated this fish was placed in an examination tray equipped with hoses that provided flowing water with 30 mg/L of MS-222® directly to the mouth and over the gills throughout the examination. Another fish was then scanned for a PIT tag and if not tagged, placed in the bucket of water with 80 mg/l MS-222®. Staff then carefully examined the left lateral line, unpaired fins and both sides of the head on the fish in the examination tray for bubbles associated with GBT using a stereo microscope. The examiner recorded species, origin, fork length, presence or absence of bubbles, and the time at the start of the exam. The sampled fish was then placed in a bucket of freshwater with aeration and allowed to recover before it was released into a raceway. It took about 1.5 minutes to complete each examination. At the end of the day, sample data were transcribed to a database on a spreadsheet and transmitted to FPC. Those fish sampled for GBT symptoms were placed in a raceway to prevent them from being diverted to the sample tank and sampled again. These fish were treated and recorded as a separate sample with a sample rate of 100% and their numbers added to the following day's collection totals.

GBT sample summary

We collected and examined 6,334 fish for GBT symptoms every-other-day between April 7 and July 2. This total included 1,788 hatchery yearling chinook; 301 wild yearling chinook; 3,844 hatchery steelhead and 401 wild steelhead. Seventy seven fish were observed with GBT symptoms; three had some bubbles in the caudal fin; twelve had some bubbles in the anal fin; two fish exhibited bubbles in the eye; and sixty had lateral line occlusions. We sampled nearly twice as many steelhead as chinook because there were not enough chinook present at the beginning and end of the study period. We began collecting chinook on April 17, and were able to net 100 chinook per day between April 19 and May 25. We quit trying to collect chinook on June 14. In contrast, we were able to collect 100 steelhead every day throughout the study.

In addition we netted and released 2,154 fish back into the separator. Fish were rejected because they were not the correct species, or were PIT-tagged. This total included: 463 hatchery yearling chinook (419 with PIT-tags); 32 wild yearling chinook (16 with PIT-tags); 1,885 hatchery steelhead (35 with PIT-tags); 238 wild steelhead (7 with PIT-tags) and 18 wild sockeye/kokanee.

Anesthetics

The use of MS-222® as an anesthetic to safely and efficiently sedate juvenile salmonids for the daily sampling programs is an important component of the smolt monitoring programs. At LGR less than two percent, ninety-six thousand, of the nearly five million total smolts collected in 1997 were anesthetized. The Fish Passage Center provides the Smolt Monitoring Program with sample rate guidelines that minimize daily sample sizes and allow large enough samples to provide unbiased estimates of species composition, condition and the recovery of unique marks to meet overall program goals. Reviews of techniques and methods employed at different sites by FPC, USGS-BRD and SMP program staff in 1992 provided more specific guidelines for standard stock solutions, minimal induction times and total exposure times for SMP sampling programs. At LGR we have found that concentrations between 60 and 70 mg/L of MS-222® enable us to follow the general guidelines and handle the juvenile salmonids safely and efficiently.

We estimate the volume of water in both the pre-anesthetic chamber and the re-circulating sample system and accurately measure the amount of anesthetic added to obtain the desired concentration. In both applications the effective concentration diminishes over time. The pre-anesthetic chambers are not water tight and as fresh water seeps in the effective concentration decreases. In the sorting tank, with re-circulating water and anesthetic, the effective concentration diminishes as more fish are sampled and absorb the anesthetic. Some leakage and infusion of fresh water also occurs throughout the sample. As a result careful monitoring of fish behavior and response is a constant component of our sample protocols and procedures. In addition to monitoring fish behavior throughout the sample we measure induction and recovery times of fish to the anesthetic from sub-samples of fish taken periodically throughout the spring migration.

In the pre-anesthetic chamber the initial concentration of MS-222® is about 70 mg/l. This consistently sedates nearly all the fish within three minutes. Once sedated, these fish are flushed down to the sorting tank. Here the initial MS-222® concentration is about 60 mg/l. This level maintains sedation in most fish and allows some fish to gradually recover from the anesthetic and gives us sufficient time to carefully complete our sampling. Again, we continuously watch and observe fish behavior and gilling rates to ensure the safety of the fish and the efficiency of our sampling. To monitor concentrations in the sorting tank and changes over time, we conduct periodic canary tests where we isolate a fish selected at random at one end of the sorting tank and observe and record its behavior over the course of the daily sample. Healthy fish typically begin to recover and assume an upright position, tail slightly down and head up, within three to five minutes. Large fish, particularly steelhead, often become so active we have to remove them. Fish with visible injuries or with significant scale loss recovered much more slowly and some would not recover at all. When these fish are removed and placed in buckets of fresh water with an air-stone (bubbler), recovery times for healthy fish were about the same as fish removed from the sample tank within three minutes.

Anesthetic induction

Induction times to sedate fish sufficiently to minimize stress and allow staff to quickly and safely handle the fish should be greater than one but not longer than three minutes. In the pre-anesthetic chamber we recorded induction times for three batches of fish every other day this season from April 10 to July 17 and averaged the data by week (Table 7.). Steelhead dominated the batches throughout the spring migration until June 26. In July and August, age zero fall chinook were slightly more abundant than steelhead. For each batch we observed and recorded the number of fish, large and small (typically steelhead and chinook), water temperature, concentration of MS-222®, and induction times. We recorded the time of induction as that point when about 95% of the fish were ventral-side-up and gilling evenly. As water temperatures increased, average induction times decreased from 3.5 to 1.5 minutes (Figure 3). We observed that the larger fish, typically steelhead, responded more slowly to the anesthetic than did the smaller fish, typically chinook. We believe that some of the differences in induction times observed between weeks reflects this mix of large and small salmonids.

Anesthetic recovery

Over the past several seasons we have selected small sub-samples of steelhead and chinook at random (three to five fish for each) directly from the sorting tank, placed them in a dark bucket with fresh water and an air-stone and recorded recovery times. Recovery times were as short as a minute to a minute and a half up to about five minutes and averaged about three minutes. We believe the variation in recovery times reflected the level of sedation of the individuals selected as they entered the sample tank from the pre anesthetic chamber. We changed our techniques this season to establish a uniform level of sedation before we measured recovery times. Twice a week, we collected, at random, up to nine hatchery steelhead as they entered the sample tank. These fish were placed in dark buckets in water with an anesthetic concentration of 70 mg/L MS-222® and aeration where they were held for five minutes and then placed in fresh water with an air stone and allowed to recover. The time it took for each to regain and maintain typical orientation and begin swimming was recorded (Table 8). We recorded fork lengths to calculate averages for each week. It was not feasible to associate individual recovery times with fork length. The availability of hatchery steelhead after each day's sub-sample determined how often we conducted this test each week. Data were collected over 32 sample days, from April 8 through August 20.

Average recovery times decreased from about 2.5 minutes to 1.5 minutes between the first four weeks and last four weeks and appeared to decrease with warmer water temperatures (Figure 4). Although average fork lengths deviated as much as 48 mm between weeks, no clear pattern of recovery times versus fish length was evident.

Table 7. Average anesthetic induction time for sample batches at LGR between April 10 and July 17, 1997.

Sample Week*	No. Fish Sampled	Size Ratio Small:Large	Temp (°C)	Induction (seconds)
4/17	40	1:19	8.9	192
4/24	33	1:7.2	9.0	199
5/1	63	1:8	9.2	189
5/8	84	1:27	10.1	172
5/15	55	1:17.3	10.7	159
5/22	55	1:12.7	11.4	132
5/29	58	1:13.5	11.4	144
6/5	58	1:28	11.8	145
6/12	60	1:19	12.2	140
6/19	46	1:8.2	13.5	123
6/26	43	1:3.7	14.5	109
7/3	34	1:0.88	16.4	109
7/10	34	1:1.6	17.5	110
7/17	33	1:0.37	17.8	109
Average	50		12.4	145

*week ending date

Figure 3. Average anesthetic induction time for sample fish exposed to ~62 mg/L MS-222® and temperature C at LGR between April 10 and July 17, 1997.

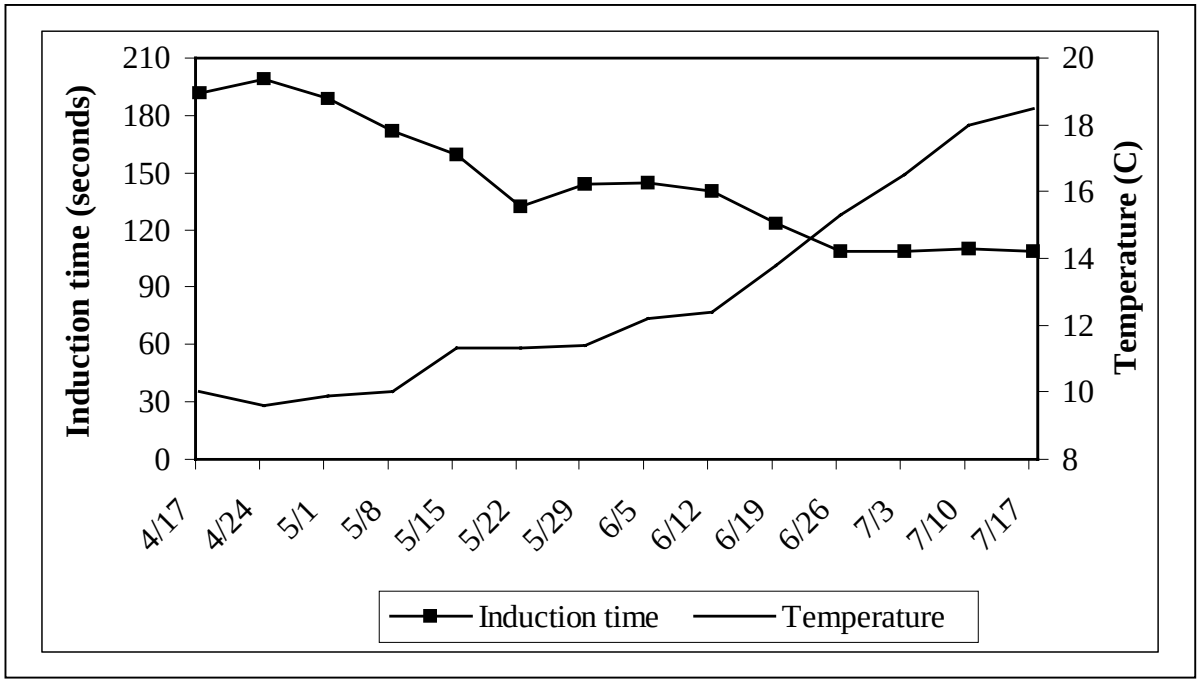
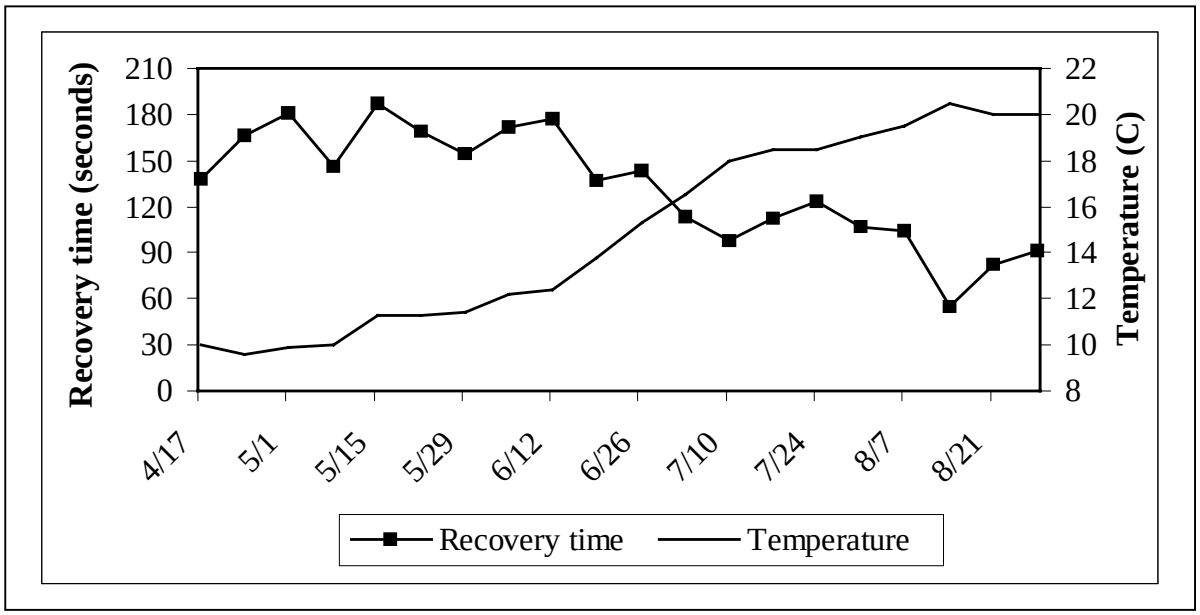


Table 8. Weekly anesthetic recovery time for hatchery steelhead tested at LGR between April 8 and August 21, 1997.

Sample Week*	No. fish Sampled	Fork Length (mm)	Temperature (C)	Recovery Time (seconds)
4/17	9	223	10.0	138
4/24	13	216	9.6	166
5/1	11	212	9.9	181
5/8	11	201	10.0	146
5/15	10	220	11.3	187
5/22	10	225	11.3	169
5/29	10	226	11.4	154
6/5	9	212	12.2	172
6/12	7	214	12.4	177
6/19	10	213	13.8	137
6/26	10	214	15.3	143
7/3	10	224	16.5	113
7/10	10	215	18.0	98
7/17	10	192	18.5	112
7/24	10	208	18.5	123
7/31	10	227	19.0	107
8/7	7	226	19.5	104
8/14	10	207	20.5	55
8/21	4	268	20.0	82
8/28	4	253	20.0	91
AVG	9	220	14.9	133

*Week ending date, two sample sets per week averaged together

Figure 4. Average recovery time for hatchery steelhead after sedation (70 mg/L MS-222®) and temperature at LGR between April 8 and August 21 in 1997



Fish Condition

Descaling

Smolt Monitoring Program staff recorded descaling data for smolts sampled at Lower Granite Dam to help monitor the overall fish condition. Numerous events in the course of fish life can result in scale loss and many fish grow new scales to replace those lost. We commonly observe areas of new scale growth and/or regeneration on fish in the sample. We also observe patterns of scale loss that appear fresh and in all likelihood are a result of events that occur as the fish entered the collection system and fish facility. Sudden increases in descaling rates typically indicate some problem within the collection system caused by debris or equipment. These increases prompt quick facility inspections to look for possible problems. Scale loss is recorded both for the total daily sample and the detailed sub-sample. In the total sample scale loss is simply tallied whenever scale loss on one or both sides of the fish exceeds twenty percent. In the detailed sample we also note the pattern of scale loss, patchy or scattered. Patchy scale loss appears as a continuous area wiped clean of scales. This scale loss pattern is almost always present on fish found dead in the sample tank. Scattered scale loss appears as missing scales scattered over both sides. Scattered scale loss is very common in hatchery steelhead. With the exception of sockeye, hatchery steelhead and chinook commonly exhibit higher rates of descaling than their wild counterparts. Sockeye/kokanee are highly susceptible to scale loss.

The total descaling rate this year, 6.2%, was the highest recorded in the last five years (Table 9). Descaling percentages were derived using both the sub-sample and total sample data. While the overall rates are comparable, the descaling rates for fish in the sub-sample were somewhat higher than the total sample. Subsample descaling rates for hatchery and wild yearling chinook and hatchery steelhead were 6.2, 2.2 and 9.6 percent compared to the total sample, 5.6, 2.8 and 6.2 percent, respectively.

This season's higher total descaling rate was consistent with the large amounts of debris present throughout the season. Descaling rates for yearling chinook and wild steelhead increased significantly from previous years, nearly doubling compared to last season. Hatchery steelhead descaling decreased 0.1% to 6.2% for the season. Wild subyearling chinook descaling decreased from 9.3% last year to 7.4% this year. Migration timing may account for some of this difference. Total weekly average descaling rates were highest in mid-May during the spring migration (Table 10). Hatchery and wild subyearling chinook descaling rates were highest from the week ending August 21 through September. We sampled relatively few hatchery and wild sockeye/kokanee (163 and 142) and hatchery coho (105) this season and suspect that the recorded descaling rates may not be representative.

Table 9. Annual descaling rates in percent for fish sampled at Lower Granite Dam, 1993-1997.

	Yearling Chinook		Subyearling[1] Chinook		Steelhead		Sockeye/Kokanee[2]		Coho[3]	
Year	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Total
1993	4.5	3.9	---	4.2	6.3	1.7	---	27.3	---	4.6
1994	3.7	3.6	---	2.1	5.4	2.0	---	12.5	---	4.3
1995	2.7	0.9	---	5.4	7.7	1.0	3.2	30.1	---	5.0
1996	3.0	1.5	---	9.3	6.3	1.1	3.8	18.4	2.4	5.8
1997	5.6	2.8	6.5	7.4	6.2	2.7	9.9	24.5	0.9	6.2

[1]Hatchery subyearling chinook were not present until 1997.
[2]Hatchery sockeye/kokanee were not present until 1995.
[3]Hatchery coho were not present until 1995.

Table 10. Percent descaling by species by week for juvenile salmonids sampled at Lower Granite Dam in 1997.

Week Ending	Yearling Chinook		Subyearling Chinook		Steelhead		Sockeye/Kokanee		Coho	
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Total
Apr 03	*0.0	*2.9	_	_	1.6	2.9	_	*33.3	_	2.2
Apr 10	*10.0	0.0	_	*0.0	1.3	1.8	_	*0.0	_	1.4
Apr 17	*1.9	0.6	_	_	2.4	1.6	_	*0.0	_	2.2
Apr 24	1.2	5.2	_	_	3.7	0.8	_	*0.0	_	3.1
May 01	6.2	2.8	0.0	*0.0	2.7	1.9	_	*0.0	_	2.8
May 08	3.8	*0.0	_	_	2.7	2.2	*0.0	*0.0	*0.0	2.9
May 15	9.6	*8.3	_	*0.0	10.1	3.4	*0.0	*0.0	*0.0	9.6
May 22	6.0	*0.0	_	*0.0	14.6	2.6	_	*33.3	*0.0	13.1
May 29	6.8	*0.1	_	*0.0	10.7	2.1	_	*20.0	*0.0	10.2
Jun 05	9.6	*5.7	_	*0.0	10.6	4.7	_	*25.0	*3.8	10.2
Jun 12	6.7	*0.0	_	*0.0	9.8	*2.3	_	*0.0	*0.0	9.1
Jun 19	4.2	*3.6	1	*1.8	6.1	*10.6	_	*20.0	*0.0	5.7
Jun 26	*13.5	*0.0	2.6	4.4	4.7	*11.5	_	*33.3	*0.0	4.9
Jul 03	*8.5	*0.0	1.2	2.8	4.0	*7.7	_	*46.2	*0.0	3.3
Jul 10	*11.1	*0.0	1.6	2.1	5.2	*13.3	*0.0	*33.3	0.0	3.5
Jul 17	*0.0	*0.0	2.3	2.8	6.0	*0.0	*12.5	*22.2	*0.0	3.2
Jul 24	*42.9	_	4.4	9.5	8.3	*7.4	*0.0	*33.3	_	5.7
Jul 31	_	_	6.5	4.9	13.3	*0.0	*0.0	*0.0	_	6.7
Aug 07	*100.0	_	7.0	5.7	15.6	*6.3	*0.0	*0.0	_	7.6
Aug 14	_	_	6.0	3.4	7.5	33.3	*0.0	*0.0	_	5.9
Aug 21	_	_	9.9	10.7	14.2	*14.3	*28.6	*0.0	_	11.0
Aug 28	_	_	7.9	6.5	16.3	*0.0	*20.0	*0.0	_	8.4
Sep 04	_	_	12.3	9.6	*6.7	*4.2	*16.7	*0.0	_	12.2
Sep 11	_	*0.0	11.4	7.1	*12.5	*13.3	*16.7	*0.0	_	9.8
Sep 18	_	*0.0	10.8	9.5	*3.8	*0.0	*0.0	*25.0	_	10.0
Sep 25	_	_	13.6	8.0	*0.0	*8.3	*16.7	*0.0	_	10.2
Oct 02	_	_	17.3	10.1	*0.0	*6.3	*6.7	*0.0	_	13.0
Oct 09	_	_	13.5	4.5	*50.0	*0.0	*0.0	*0.0	_	9.1
Oct 16	_	_	*16.4	*8.2	*0.0	_	*37.5	*100.0	_	14.7
Oct 23	_	_	*7.7	*21.2	*0.0	*0.0	_	*66.7	_	14.0
Oct 30	_	_	*11.1	*16.7	*0.0	*0.0	*0.0	*100	_	12.8
Nov 6	_	_	*16.7	*14.3	*0.0	*0.0	*0.0	*0.0	_	11.1
Total Descaled	164	26	1,243	465	3,691	134	14	40	1	5,778
Total Exmined	2,901	920	18,987	6,320	59,341	4,897	142	163	105	93,776
Percent Descaled	5.6	2.8	6.5	7.4	6.2	2.7	9.9	24.5	0.9	6.2

*Less than 100 fish sampled during the week.
_No fish sampled during the week

Injury and disease

In addition to detailed length and weight data collected in daily sub-samples, we also examined and recorded data on injury and disease. This season we examined 25,351 smolts in the sub-sample for injuries associated with the head and body, and for symptoms of diseases. Of this total, 2,637 fish, or 10.4%, exhibited some signs of disease or injury other than descaling compared with 13.6% of the fish examined in 1996. The most frequent ailment observed during 1997 was fin hemorrhaging. Visible symptoms of this condition were pink to red pelvic and anal fins. The coloration from capillary dilation in these tissues and is considered a response to stress (ODFW fish pathologist Warren Groberg, pers. comm.). We recorded this condition in 10.1% of all wild and hatchery subyearling chinook. Fin hemorrhaging was much more prevalent last season. In 1996 20.9% of wild subyearling chinook and 3.7% of the hatchery steelhead examined in the sub-sample showed this symptom.

We recorded symptoms of columnaris and gill hyperplasia. Columnaris, characterized by circular yellowish lesions and associated with high water temperatures, was observed in late-summer migrants. This disease was recorded on 0.9% of the hatchery subyearling chinook and 0.6% of wild subyearling chinook examined in the sub-sample. In 1996, columnaris was recorded in 0.3% of sub-sampled wild subyearling chinook. Gill hyperplasia in hatchery steelhead, characterized by swollen or "club-shaped" gill filaments, decreased from 13.5% in 1996 to 6% this year and was most prevalent during the peak of the spring migration.

As in 1996, the majority of injuries resulting from predators appeared to be from birds. Bird predation marks, characterized by V-shaped scratches on both sides of a fish, were most prevalent on hatchery steelhead (2%) and wild steelhead (1.4%) this year. In 1996, 2.5% of hatchery steelhead and 0.8% of wild steelhead sub-sampled had bird predation marks. Head injuries recorded in sub-sample fish included eye damage, torn or folded operculum plate, jaw and maxillary bone damage. Eye injury rates were between 0.1% and 0.4%. Operculum damage was highest in hatchery yearling chinook (0.7%) and hatchery steelhead (0.9%). Jaw bone and maxillary bone damage was less than 0.2% for all species except wild sockeye/kokanee (3.0%). The incidence of body injuries, including fin damage, body scars and lacerations was low this season. Fin damage was the most prevalent body injury in subyearling chinook (hatchery 0.5% and wild 0.6%) and hatchery steelhead (0.5%). Body injury rates for all species this season were similar to rates observed in 1996.

Incidental species

Sample incidentals

In addition to recording the number of salmonid smolts, we also recorded other species of fish that were collected at the juvenile fish facility (Table 11). These incidental fish were tallied during daily samples and their counts expanded according to the daily sample rates. Fish that were small enough to pass through the separator bars and end up in the sample tank or the raceways were a mixture of adult and juveniles though we did not keep age class records. In the sample, a total of 12,585 non-salmonid fishes were identified during the season. These fish were not transported but represented a total collection 63,540 incidentals of which the balance was transported.

Incidentals removed from the separator were predominantly adult fish too large to pass through the separator bars. A total of 5,044 were counted and sent back to the river. The majority of those fish were suckers and carp. When we applied daily sample rates to non-salmonid counts from the sample (and added separator counts), we estimated that over 61,000 non-salmonids were collected at the juvenile fish facility.

Rainbow trout were one of the most abundant incidental species this season with an estimated collection of 10,134 fish. This number is the result of sample rate expansions applied to just 200 fish. Most of these fish were sampled during the peak of the spring migration when the sample rates were low. Fish 65 mm and less were recorded as rainbow trout. This reflects a change in data recording procedures. In past years, all small, 65 mm or less, rainbow trout were identified as wild steelhead. This year the fish were classified as rainbow trout to distinguish them from larger steelhead smolts.

Table 11. Collection of incidental fish species at Lower Granite Dam, 1997.

Common Name	Scientific Name	Separator	Sampled/ Collected	Total Collection
Bass, Largemouth	*Micropterus salmoides*	0	0	0
Bass, Smallmouth	*M. dolomieui*	2	238	240
Bluegill	*Lepomis machrochirus*	0	86	86
Bullhead (misc.)	*Amierus sp.*	0	74	74
Carp	*Cyprinus carpio*	1656	69	1725
Channel catfish	*Ictalurus punctatus*	92	399	491
Chiselmouth	*Acrocheilus alutaceus*	1	6817	6818
Crappie	*Pomoxis sp.*	2	7956	7958
Crayfish	*Cambarus sp.*	0	11	11
Dace, Longnose	*Rhinichthys cataractae*	0	10	10
Kokanee2	*Oncorhynchus nerka*	3	1017	1020
Lamprey, Pacific (Adult)	*Entosphenus tridentatus*	30	37	67
Lamprey, Pac. (Ammocete)	*E. tridentatus*	0	8699	8699
Lamprey, Pacific (Juv.eyed)	*E. tridentatus*	0	3425	3425
Peamouth	*Mylocheilus caurinus*	0	9744	9744
Pumpkinseed	*Lepomis gibbosus*	0	217	217
Rainbow Trout	*Oncorhynchus mykiss*	0	10173	10173
Sandroller	*Percopsis transmontana*	0	0	0
Sculpin	*Cottus sp.*	0	252	252
Shad (Adult)	*Alosa sapidissima*	12	6	18
Shad (Juvenile)	*A. sapidissima*	0	5	5
Shiner, Redside	*Richardsonius balteatus*	0	3	3
Squawfish	*Ptychocheilus oregonensis*	1	650	651
Sturgeon, White	*Acipenser transmontanus*	106	2	108
Sucker (misc.)	*Catostomus sp.*	3165	8232	11397
Tadpole Madtom	*Noturus gyrinus*	0	0	0
Three-spine stickleback	*Gasterosteus aculeatus*	0	0	0
Walleye	*Stizostedion vitreum*	0	0	0
Whitefish	*Prosopium sp.*	10	5267	5277
Yellow perch	*Perca flavescens*	0	151	151
Total		5080	63540	68620

[1]Incidental species collection estimated based on numbers sampled, sample rates, and separator counts.
[2]Kokanee in the sample are classified as any sockeye juvenile over 200 mm in length.
[3]Rainbow trout were distinguished from steelhead by having fork lengths less than 65 mm.

Adult Fallbacks

A total of 9,042 adult salmonids were removed from the Lower Granite separator in 1997. This is much higher than the preceding three years 1994-1996, but less than in 1993 (Table 12). Hatchery steelhead were the most abundant adult salmonid removed from the separator and made up 73.1% of the total fallbacks during 1997. Wild steelhead were the second most abundant salmonid and made up 21.5% of the fallbacks. As is typical at Lower Granite Dam, April and May were the months of highest fallback for hatchery and wild steelhead. May and June were the months of highest adult fallback for adult chinook (Table 13).

Numbers of adult chinook removed from the separator were considerably higher this year but the number of jack chinook was lower than in 1996. Based on the previous four years, the number of adult chinook falling back was well above average while jack chinook fallbacks were the lowest recorded over the Lower Granite separator since 1994. There were three adult sockeye and one coho fallback recorded during the season. Numbers of adult hatchery steelhead were well above the four-year average while wild steelhead fallbacks were slightly below average. All fallbacks were quickly examined for condition while being released off the separator. The vast majority of the fish were in good or fair condition (Table 14).

Table 12. Total numbers of adult salmonids released from the juvenile fish separator at Lower Granite Dam from 1993-1997.

Year	Adult Chinook	Jack Chinook	Hatchery Steelhead	Wild Steelhead	Total
1993	212	49	7,410	4,312	11,983
1994	8	10	2,063	1,476	3,567
1995	60	49	3,660	2,127	5,896
1996	150	70	5,385	1,167	6,772
1997	470	19	6,609	1,944	9,042

Table 13. Total numbers of adult salmonids released from the juvenile fish separator by month at Lower Granite Dam in 1997.

Month	Adult Chinook	Jack Chinook	Hatchery Steelhead	Wild Steelhead	Total
April[1]	0	0	2,245	485	2,730
May	155	1	2,546	700	3,402
June	182	1	187	374	744
July	54	4	56	81	195
August	8	0	157	28	193
September	13	3	532	89	637
October[2]	58	10	886	187	1,141
Total	470	19	6,609	1944	9,042

[1] Includes March 27-31.
[2] Includes November 1.

Table 14. Condition of adult salmonids released from the juvenile fish separator at Lower Granite Dam in 1997.

Condition	Adult Chinook	Jack Chinook	Hatchery Steelhead	Wild Steelhead	Total
Good	397	18	4,813	1,806	7,034
Fair	39	1	1,236	103	1,379
Poor	15	0	402	19	436
Dead	19	0	158	16	193
Total	470	19	6,609	1,944	9,042

Fish Collection

Migration and Collection

An estimated 4.7 million juvenile salmonids were collected this season. Fish collection and transportation numbers were substantially below those of the past several years (Table 15). Hatchery and wild yearling chinook collection totals exhibited the most dramatic declines, although hatchery and wild steelhead collection numbers were also less than the average for the past four years. Some of this decline reflects spill at Lower Granite and the operation of the experimental Surface Bypass Collector. Spill during the two peak flow months of May and June this season exceeded those of the previous year by 24% and 18%, respectively. The SBC, a prototype surface route for fish to pass the dam, was operated through most of the spring migration period. The decline for wild yearling chinook also reflects the poor adult escapement above Lower Granite in 1995.

Table 15. Annual collection, bypass, and transport at Lower Granite Dam, 1993-1997.

Year	Yearling Chinook		Subyearling[1] Chinook		Steelhead		Sockeye/Kokanee[2]		Coho[3]	Total
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	
Collection										
1993	1,442,819	339,349	---	16,469	5,722,730	500,906	---	3,348	---	8,025,621
1994	1,862,390	316,939	---	6,769	4,223,477	477,925	---	23,201	---	6,910,701
1995	2,991,449	789,070	---	31,019	5,501,552	414,082	2,552	3,773	---	9,733,497
1996	462,995	126,895	---	17,346	4,264,688	321,821	5,137	9,762	19,028	5,227,672
1997	224,847	56,978	73,437	17,473	4,022,510	300,215	411	2,937	1,517	4,700,325
Bypass										
1993	74,413	5,451	---	0	329,406	28,560	---	0	---	437,830
1994	14,618	555	---	3	39,487	2,384	---	105	---	57,152
1995	222,928	53,260	---	1,590	368,705	22,014	1	104	---	668,602
1996	49,978	19,332	---	358	30,883	977	0	0	765	102,430
1997	407	787	1,031	617	110,753	2,941	0	0	29	116,565
Truck										
1993	4,798	9,852	---	16,018	40,601	3,694	---	605	---	75,568
1994	8,791	26,858	---	6,628	93,048	13,570	---	1,884	---	150,779
1995	37,526	89,658	---	28,068	71,430	13,389	2,310	784	---	243,165
1996	2,207	4,004	---	15,857	82,108	12,802	889	6,054	2,966	126,887
1997	2,659	3,100	70,793	15,221	134,154	20,533	399	799	420	248,078
Barge										
1993	1,356,565	322,921	---	245	5,351,354	468,544	---	2,651	---	7,502,280
1994	1,831,163	288,328	---	97	4,085,149	461,715	---	20,524	---	6,686,976
1995	2,722,029	644,226	---	787	5,059,422	378,619	229	2,822	---	8,808,134
1996	407,960	102,368	---	885	4,149,222	307,805	4,120	3,184	15,254	4,990,798
1997	219,683	52,679	0	998	3,774,369	276,520	0	2,022	1,066	4,327,337
Total Transported										
1993	1,361,363	332,773	---	16,263	5,391,955	472,238	---	3,256	---	7,577,848
1994	1,839,954	315,186	---	6,725	4,178,197	475,285	---	22,408	---	6,837,755
1995	2,759,555	733,884	---	28,855	5,130,852	392,008	2,539	3,606	---	9,051,299
1996	410,167	106,372	---	16,742	4,231,330	320,607	5,009	9,238	18,220	5,117,685
1997	222,342	55,779	70,793	16,219	3,908,523	297,053	399	2,821	1,486	4,575,415

[1]Hatchery subyearling chinook were not present until 1997
[2]Hatchery sockeye were not present until 1995.
[3]Hatchery coho were not present until 1996.

Migration timing

This year smolt migration at LGR appeared to start somewhat earlier and last longer than in 1996 (Figures 5 and 6). The middle 80% of the migration for hatchery yearling chinook, April 20 to May 18, began three days earlier and lasted two days longer. The wild yearling chinook run timing was earlier by one week but as long as it was in 1996. The middle 80% of the wild subyearling chinook migration also began one week earlier and at about the same time as in 1996. The middle 80% for the hatchery and wild steelhead run was slightly earlier and lasted longer this year. The run timing for hatchery coho was about one week longer.

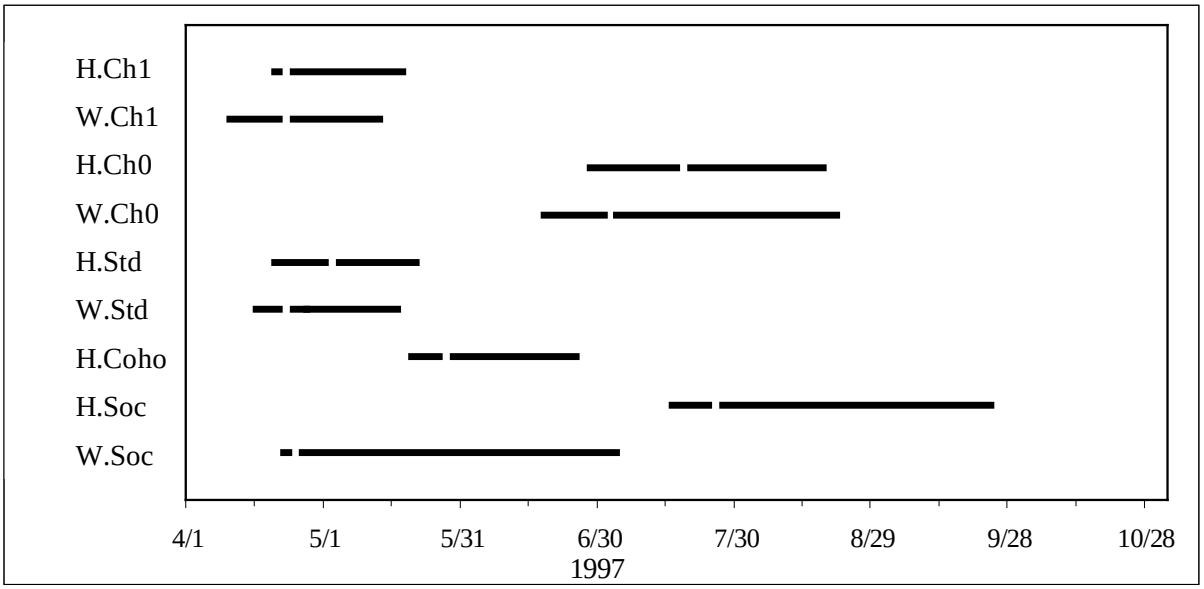
We observed three migration peaks in 1997, one in late April, early May, and mid-July. The first and last of these corresponded to river flow peaks (Figure 7). There were twenty-one days in which collection exceeded 100,000 fish and two days with more than 200,000 fish. Hatchery and wild yearling chinook collection peaked on April 22 (Table 16). A few subyearling chinook were seen in the sample in April and May, but did not appear on a regular basis until the middle of June. Wild steelhead peaked much earlier than their hatchery counterparts. Hatchery coho collection peaked on May 27 this year but peaked on May 19 in 1996. Collection peaks were generally lower this year than in recent past years.

Table 16. Annual peak collection days at Lower Granite Dam, 1993-1997.

	Yearling Chinook		Subyearling[1] Chinook		Steelhead		Sockeye/Kokanee[2]		Coho[3]	
Year	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Total
1993	May 7	April 30	---	July 19	May 7	May 7	---	May 26	---	May 7
	(126,195)	(24,698)	---	(599)	(703,941)	(53,765)	---	(201)	---	(893,100)
1994	May 10	April 24	---	July 9	May 10	April 24	---	May 12	---	May 10
	(137,577)	(27,097)	---	(470)	(353,101)	(39,698)	---	(2,411)	---	(514,500)
1995	May 2	May 3	---	July 28	May 3	May 10	July 6	May 1,10	---	May 3
	(288,000)	(30,600)	---	(1,170)	(654,000)	(34,050)	(400)	(300)	---	(910,051)
1996	May 14	April 21	---	July 13	April 27	April 27	May 17	April 2	May 19	April 27
	(31,350)	(9,000)	---	(1,004)	(366,900)	(22,350)	(750)	(910)	(1,650)	(407,550)
1997	April 22	April 22	July 18	July 2	May 2	April 22	July 25	April 22	May 27	May 2
	(13,070)	(5,730)	(2,876)	(480)	(250,146)	(27,821)	(28)	(400)	(150)	(261,350)

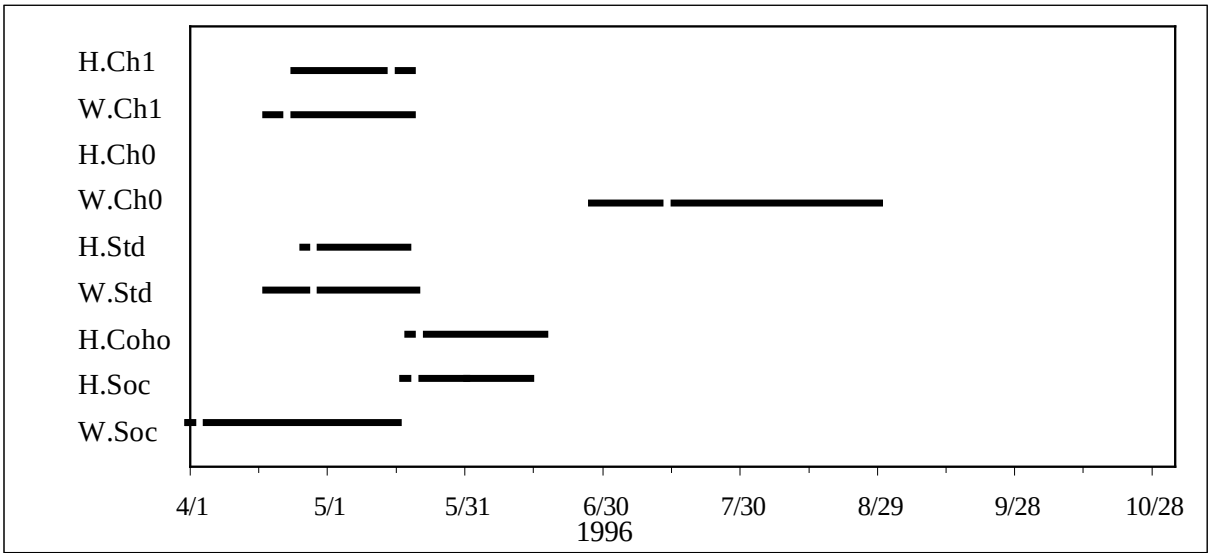
[1]Hatchery subyearling chinook were not present until 1997.
[2]Hatchery sockeye were not present until 1995.
[3]Hatchery coho were not present until 1996.

Figure 5. Passage dates of middle 80% of smolt migration and peak collection day* by species at LGR, 1997.



*Peak collection day is represented by the space dividing each bar.

Figure 6. Passage dates of middle 80% of smolt migration and peak collection day* by species at LGR, 1996.



*Peak collection day is represented by the space dividing each bar.

Figure 7. Daily juvenile salmonid collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

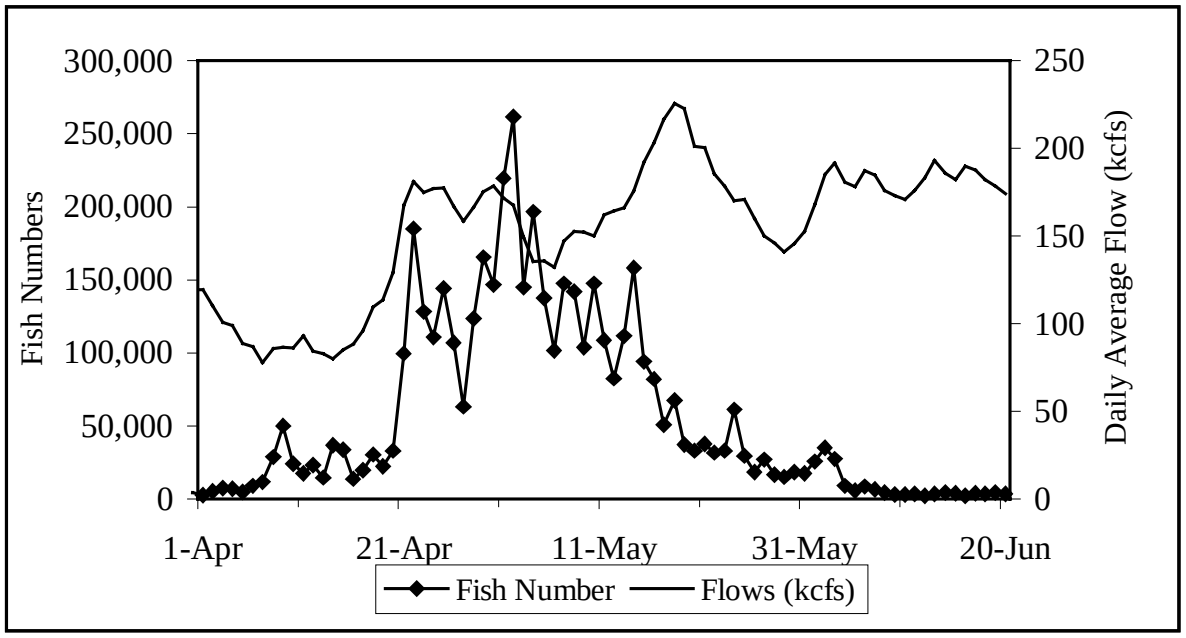


Figure 8. Daily juvenile salmonid collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

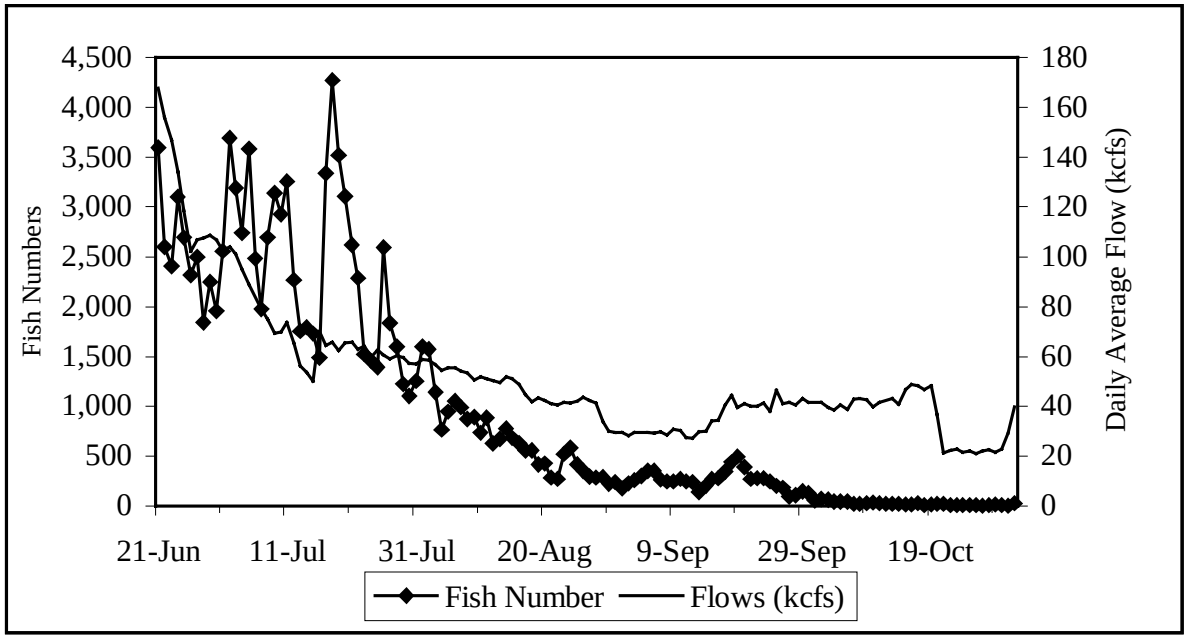


Figure 9. Daily hatchery yearling chinook collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

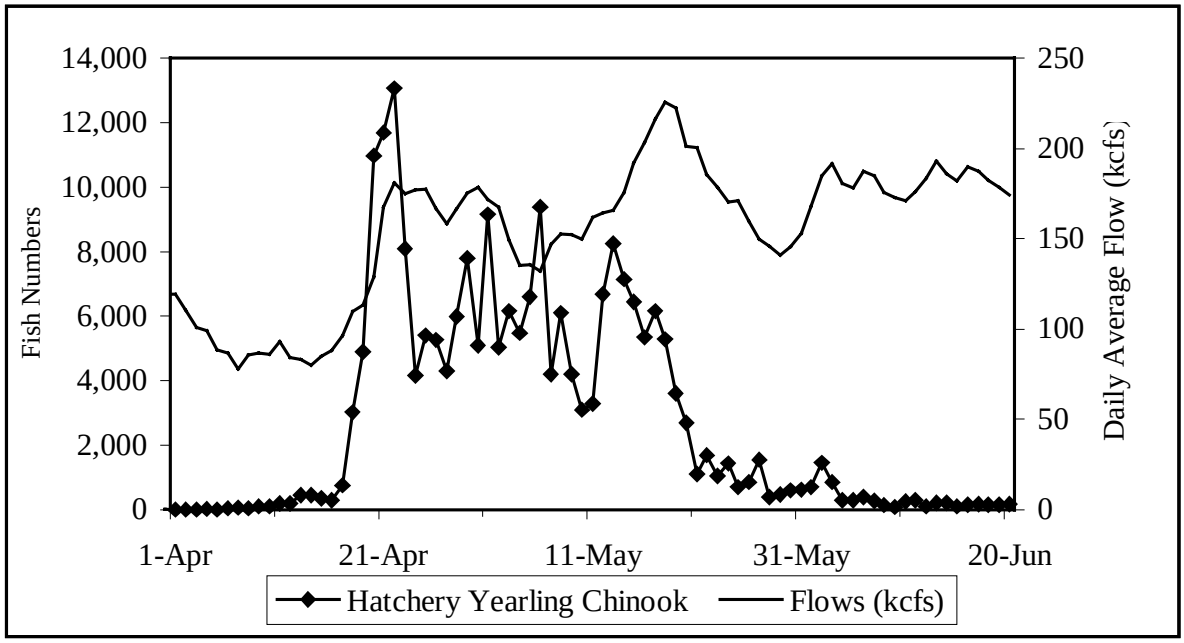


Figure 10. Daily hatchery yearling chinook collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

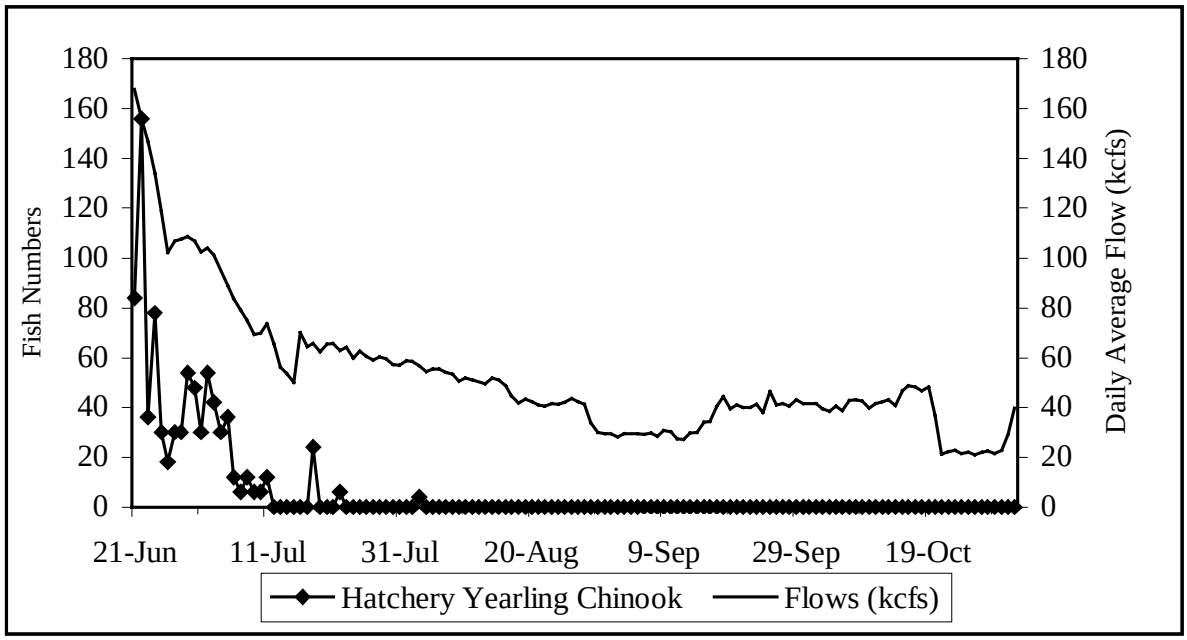


Figure 11. Daily wild yearling chinook collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

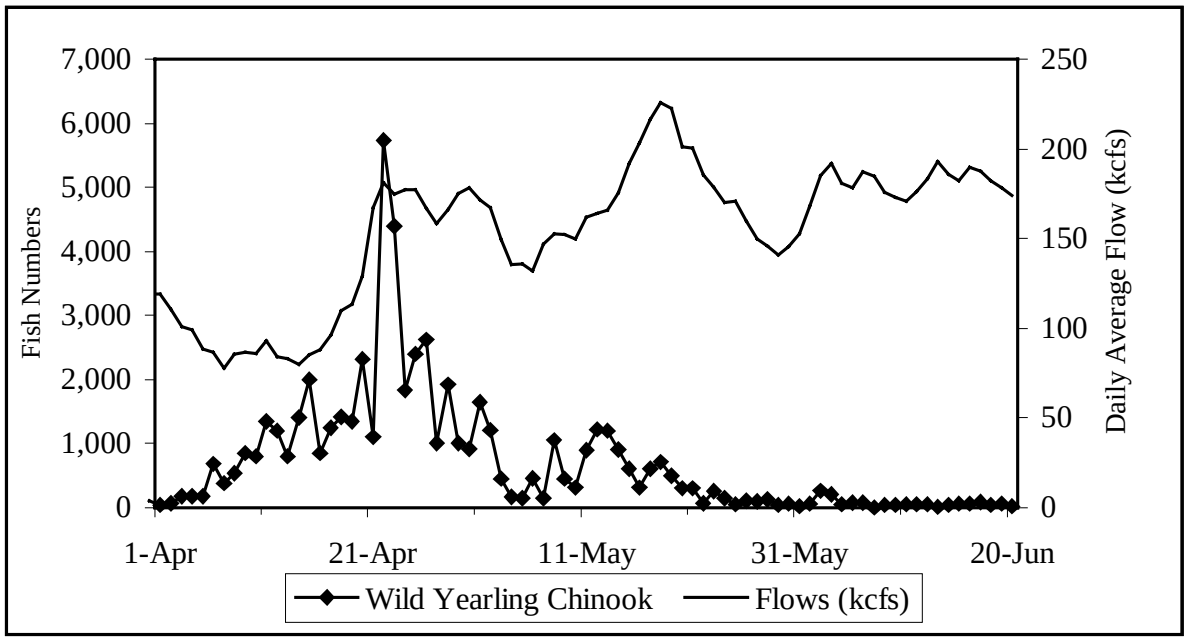


Figure 12. Daily wild yearling chinook collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

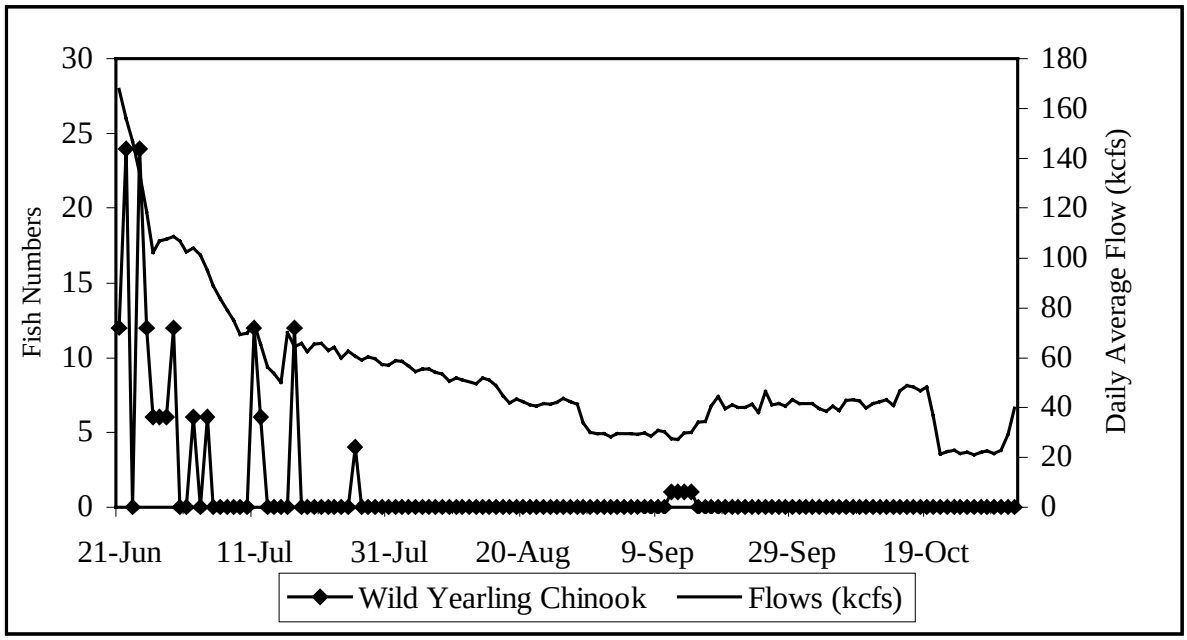


Figure 13. Daily hatchery subyearling chinook collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

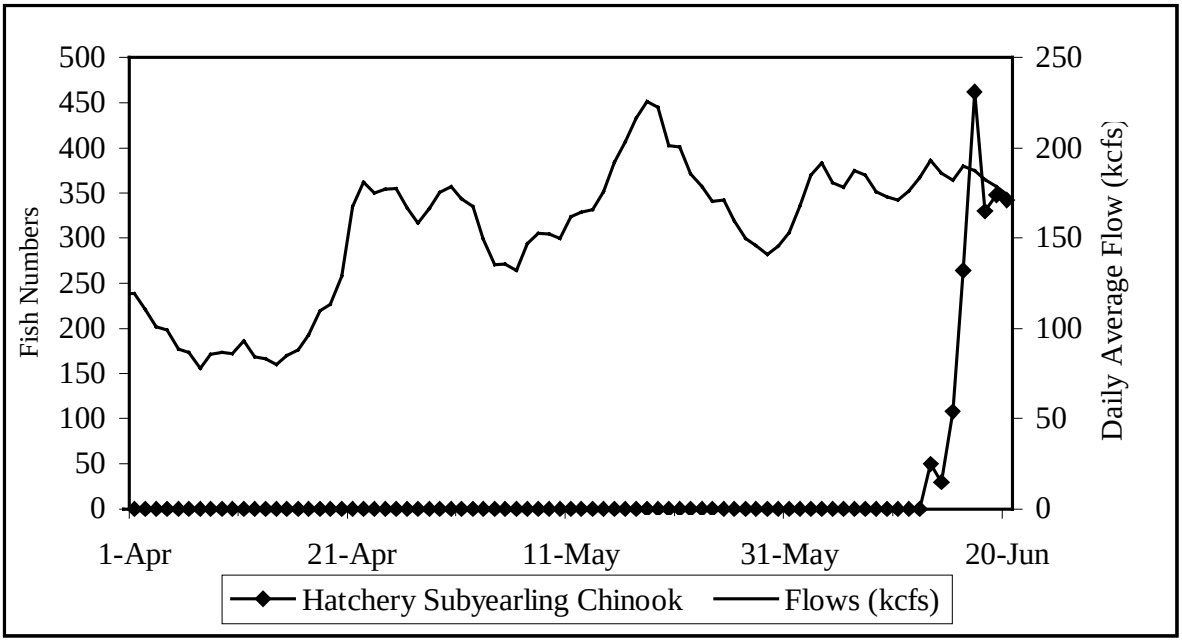


Figure 14. Daily hatchery subyearling chinook collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

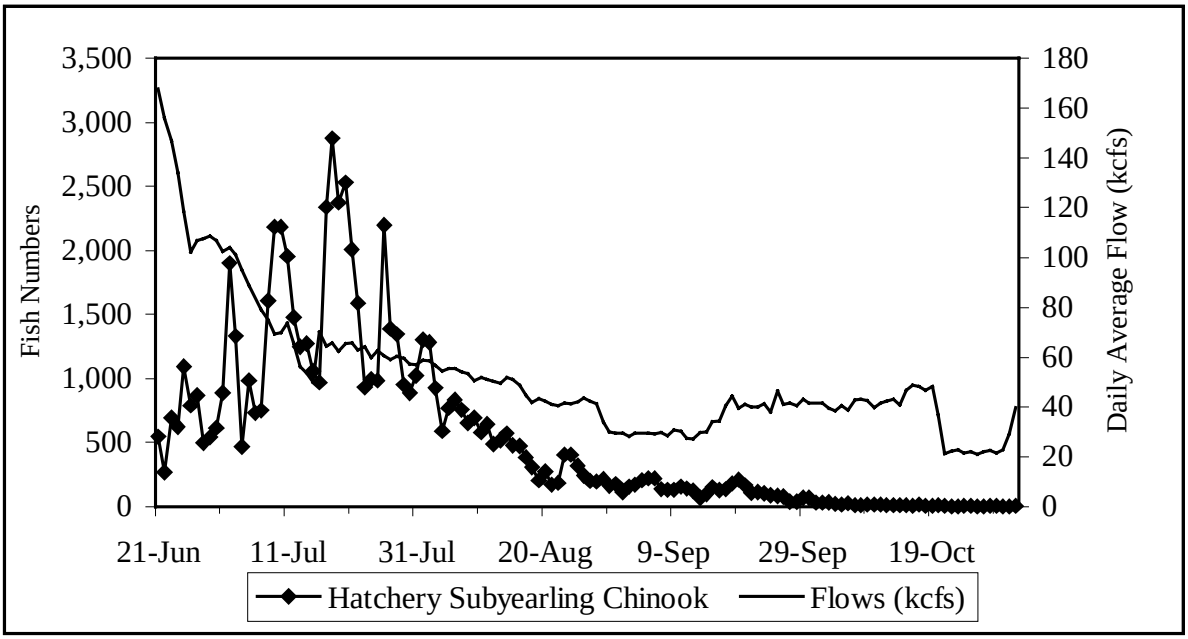


Figure 15. Daily wild subyearling chinook collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

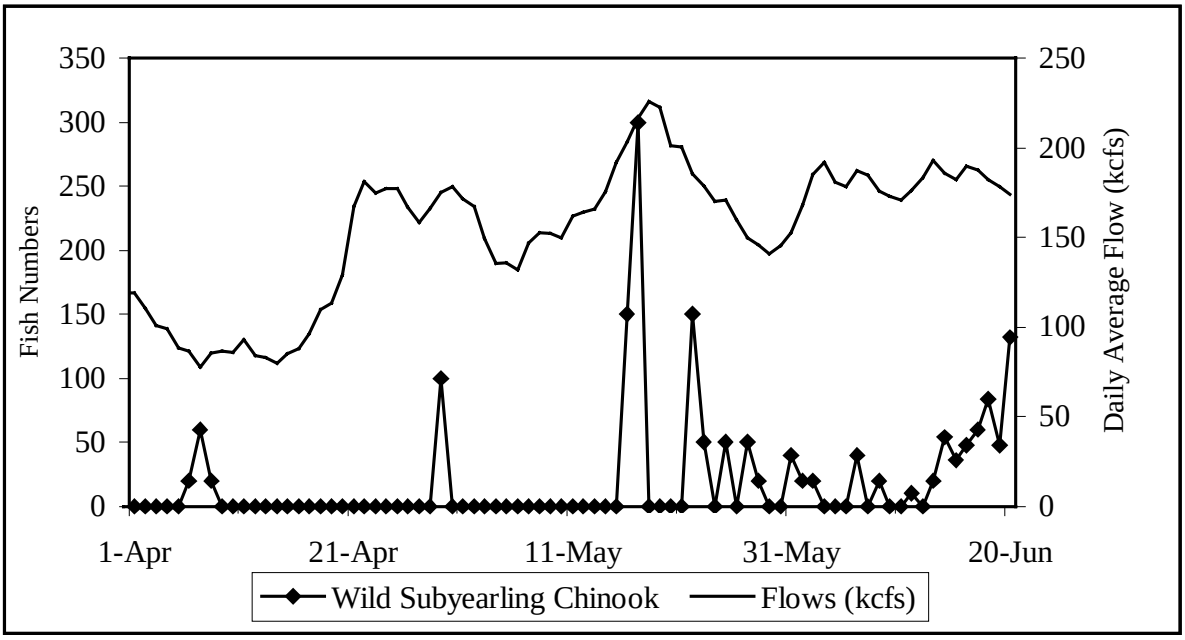


Figure 16. Daily wild subyearling chinook collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

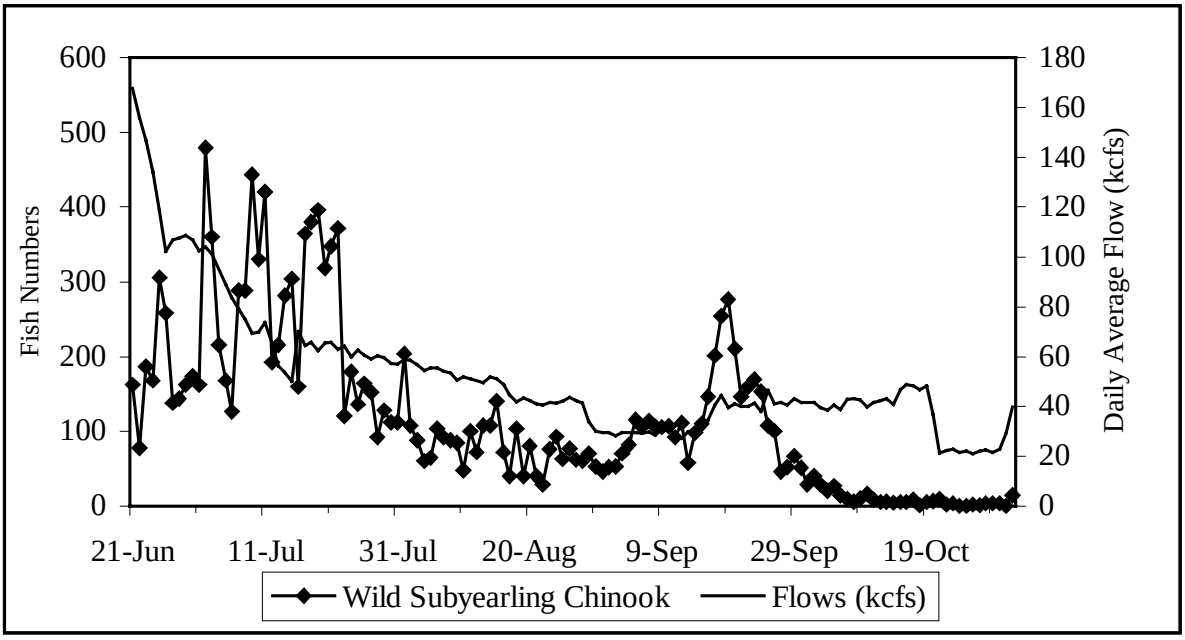


Figure 17. Daily hatchery steelhead collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

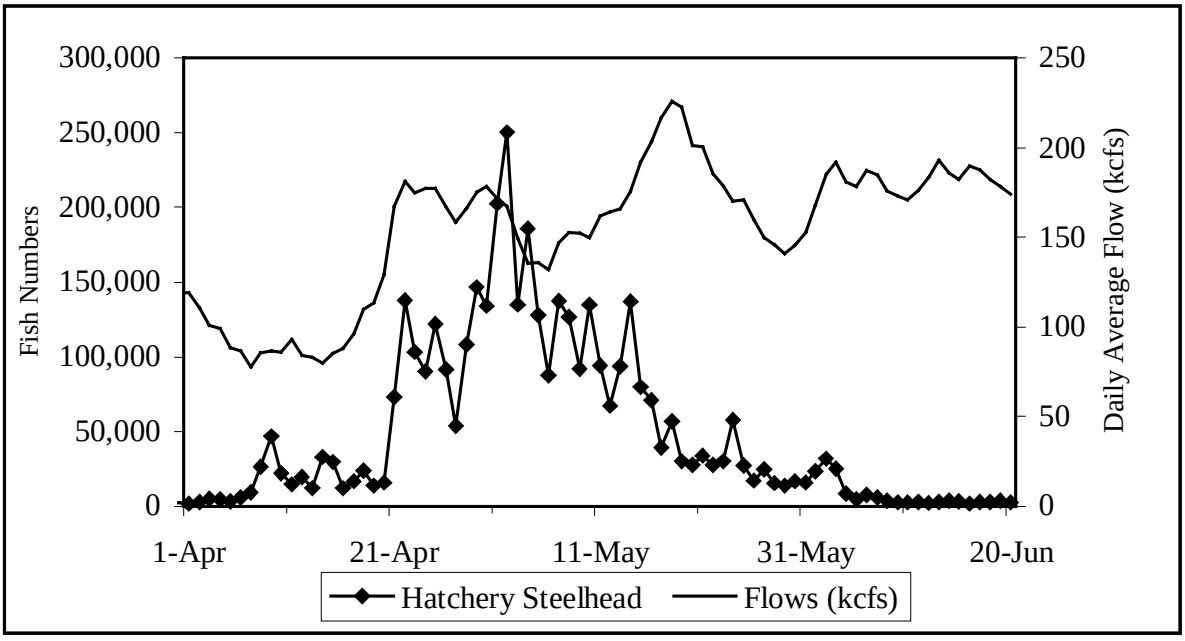


Figure 18. Daily hatchery steelhead collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

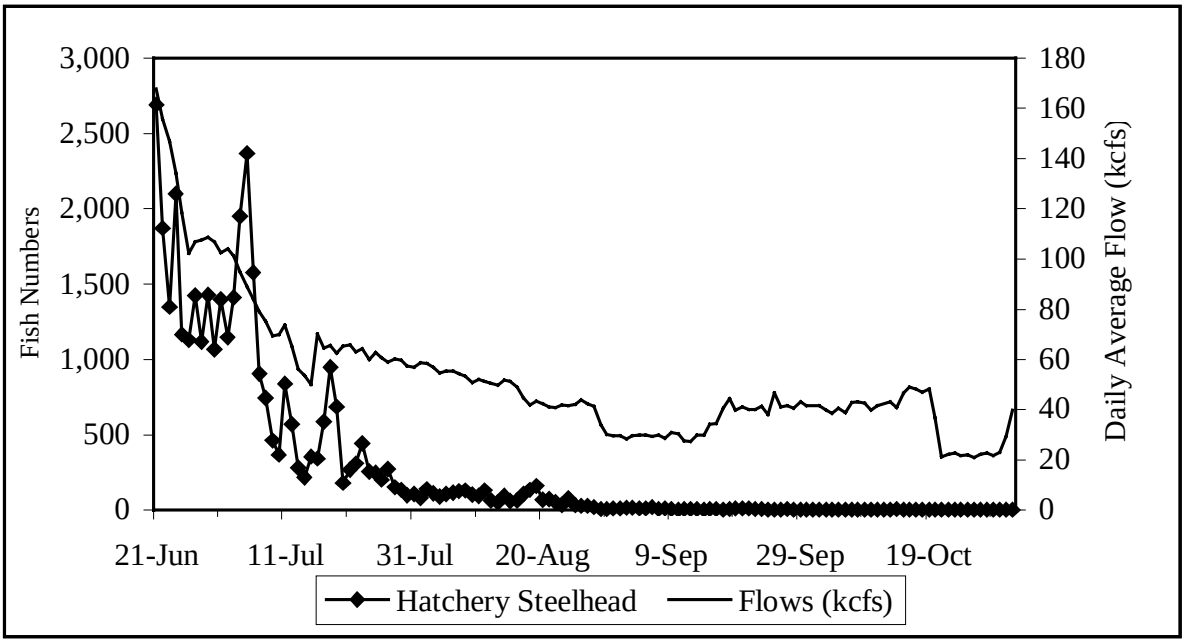


Figure 19. Daily wild steelhead collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

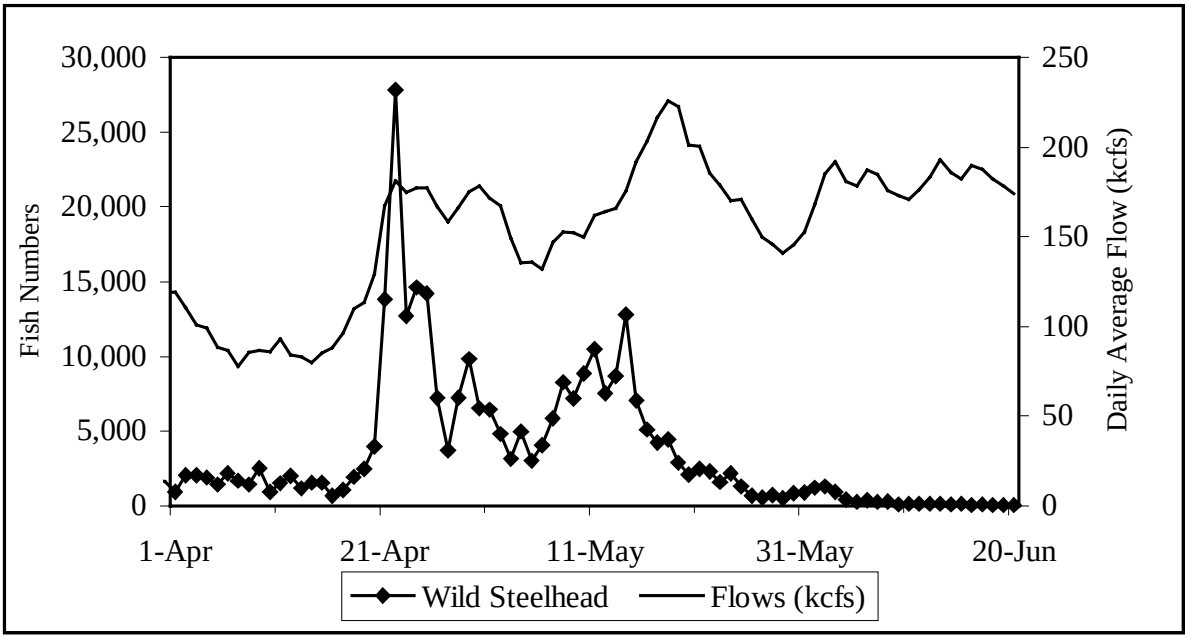


Figure 20. Daily wild steelhead collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

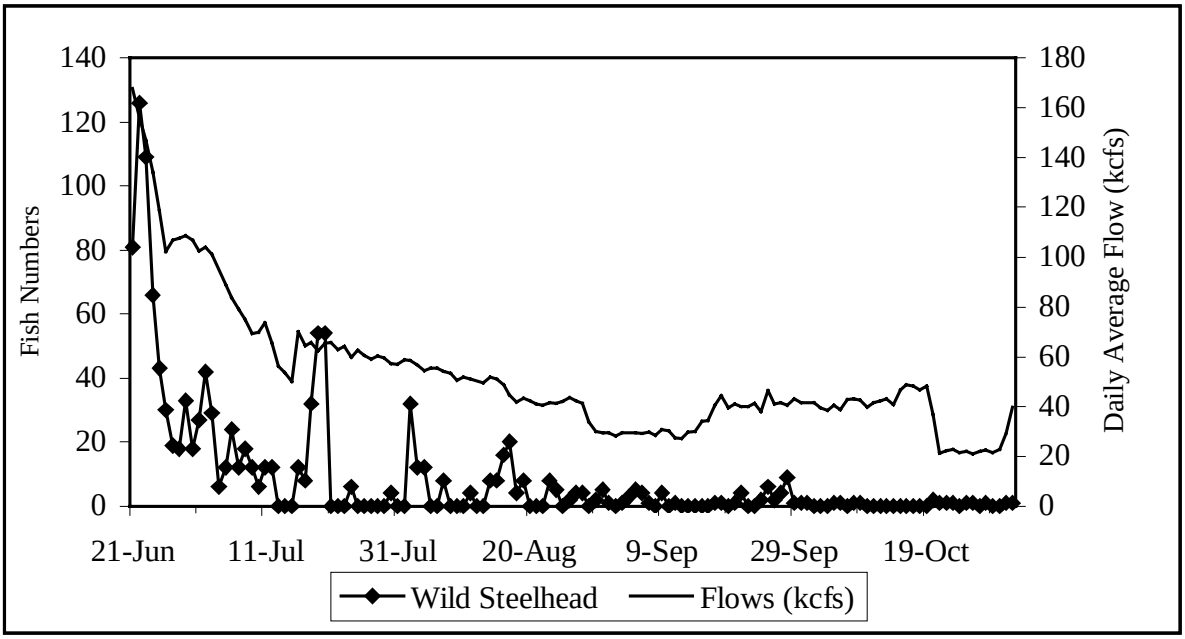


Figure 21. Daily hatchery coho collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

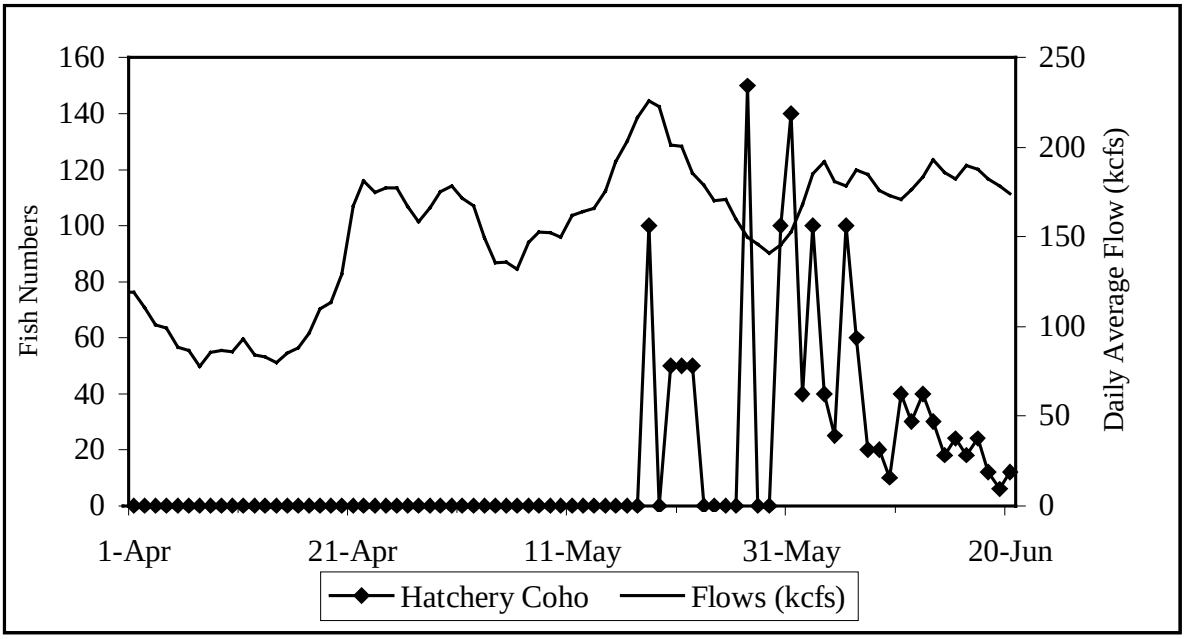


Figure 22. Daily hatchery coho collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

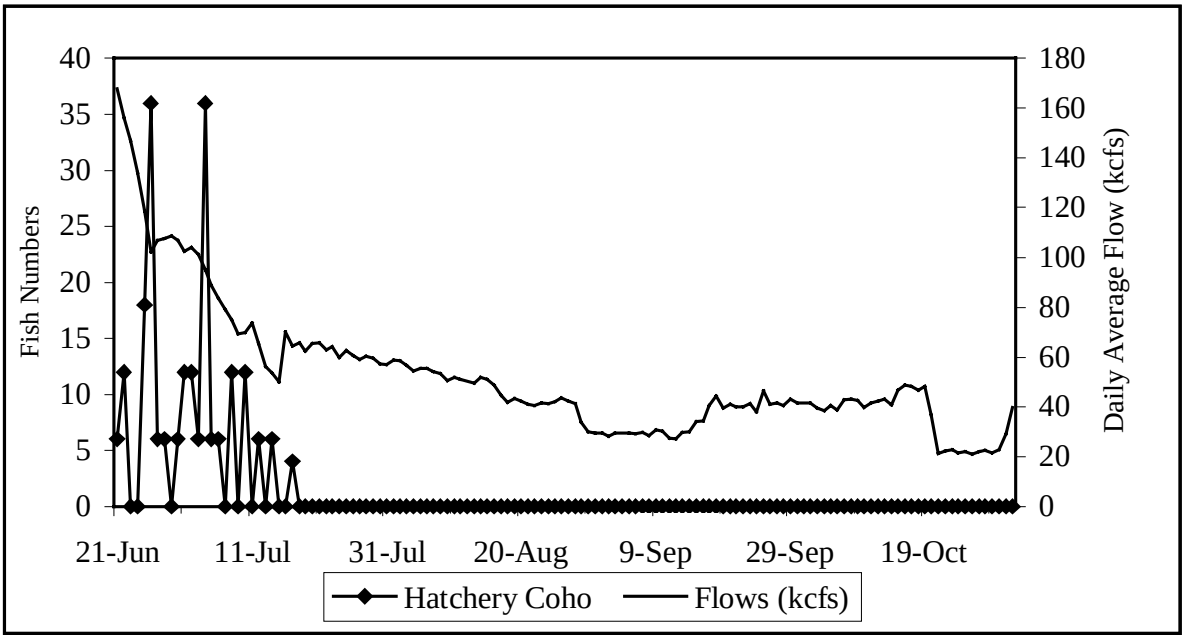


Figure 23. Daily hatchery sockeye/kokanee collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

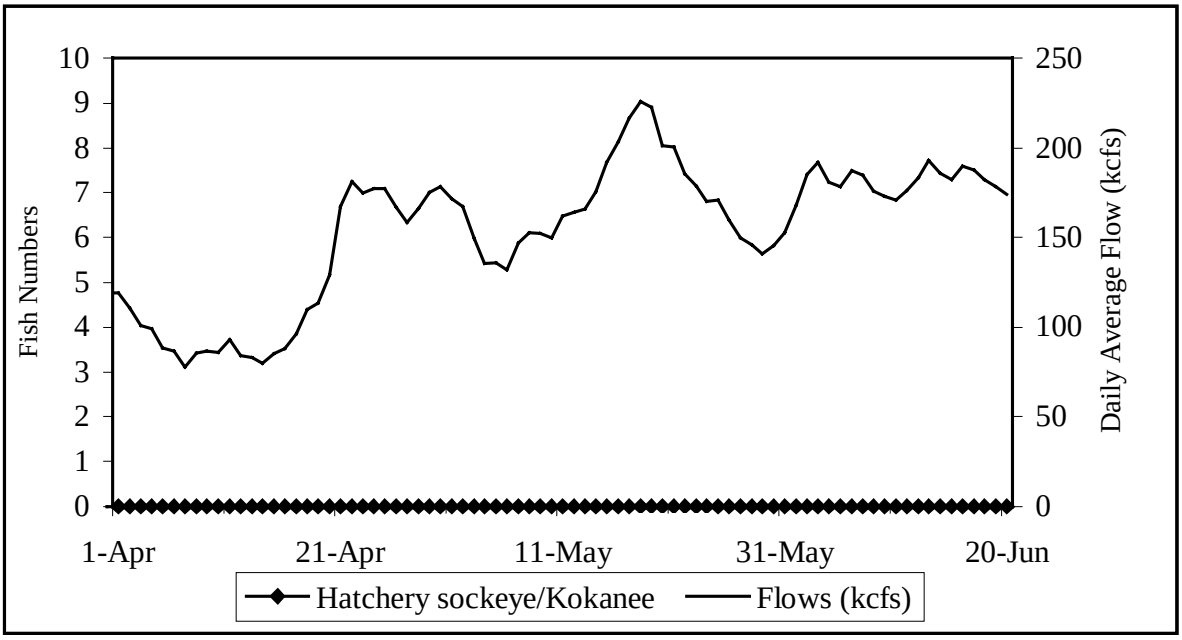


Figure 24. Daily hatchery sockeye/kokanee collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.

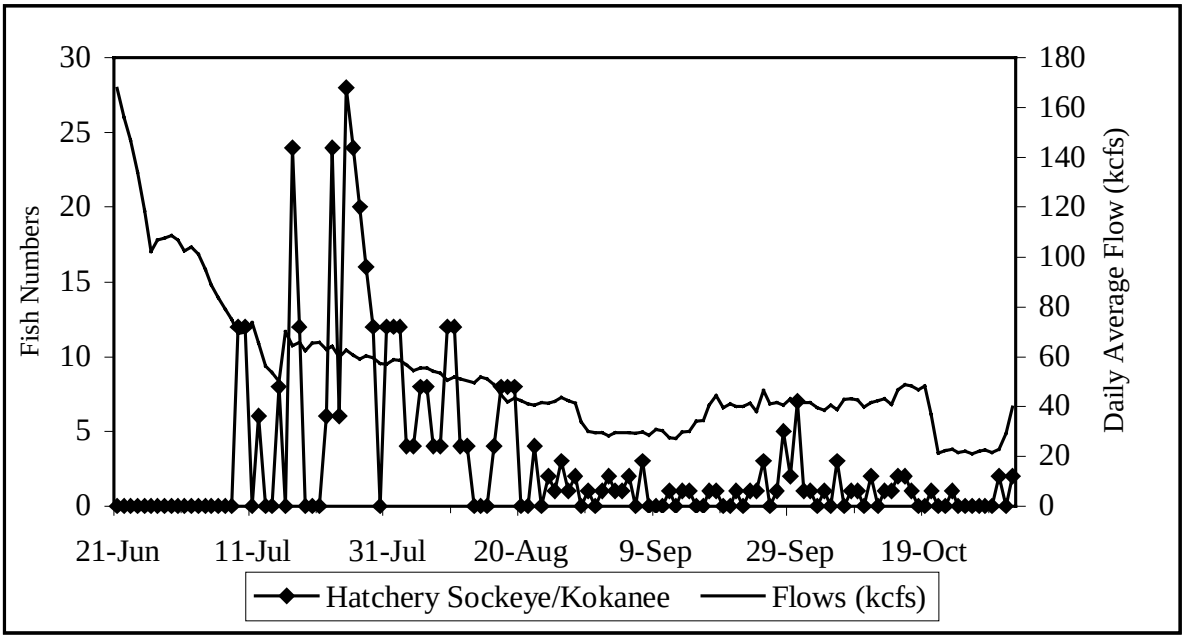


Figure 25. Daily wild sockeye/kokanee collection and river flow at Lower Granite Dam from April 1 through June 20, 1997.

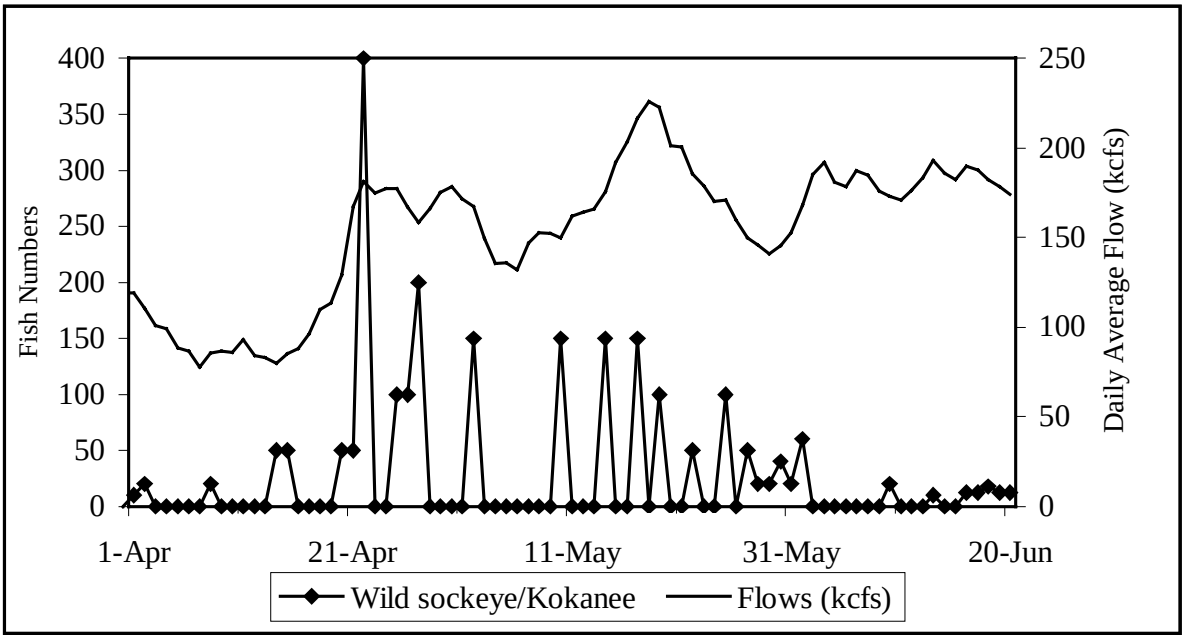
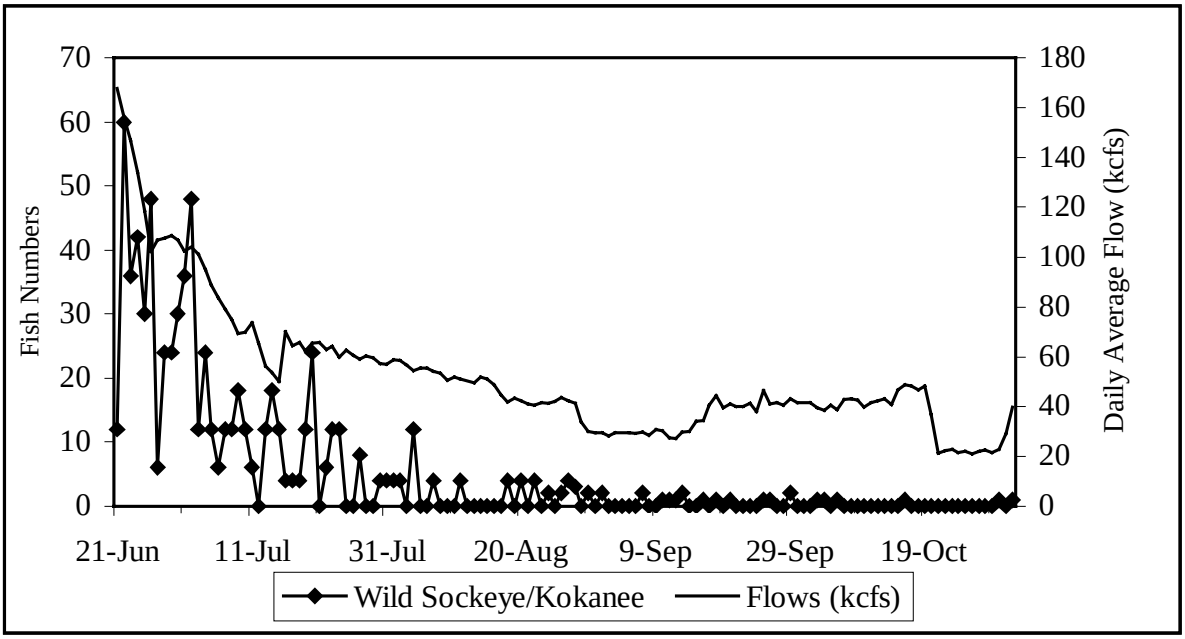


Figure 26. Daily wild sockeye/kokanee collection and river flow at Lower Granite Dam from June 21 through Nov. 1, 1997.



Transportation

An estimated 4,575,415 juvenile salmonids, 97.3% of all fish collected, were transported from Lower Granite Dam in 1997 (Table 15), and most were transported in barges. The exceptions to this were subyearling chinook and wild sockeye/kokanee. Most subyearling chinook arrived at Lower Granite after the barging season ended and were trucked. Most wild sockeye/kokanee, most likely kokanee from Dworshak Reservoir, arrived before barging began and were trucked.

Bypass

Approximately 116,565 juvenile salmonids (2.5% of collection) were bypassed from Lower Granite for various reasons in 1997 (Table 15). These numbers include fish bypassed from the raceways, fish bypassed due to research projects and steelhead bypassed to reduce densities in the mini-tanker. They do not include fish bypassed during periods of primary bypass or through the PIT tag diversion system.

There were three instances where fish where released back to the river after they had been loaded into raceways. The first of these occurred on April 9 when collection numbers exceeded the capacity of the available barge space resulting in bypassing 43,690 fish from raceways (Appendix A, Table 3). The second bypass incident occurred on June 9 when the barge loading line from raceway four (4) became clogged with debris which could not be cleared with the raceway full of water until the following day. An estimated 7,894 fish were bypassed at this time, nearly 91% of which were hatchery steelhead. The third incident occurred on August 15 when a fish truck had been loaded and was ready to leave when the driver discovered that the trailer battery had failed, rendering the belly pump and hydraulics inoperable. The fish on the truck were released at Illia Landing, about 3 miles below Lower Granite Dam. An estimated 1,440 fish were released back to the river, 71% of which were hatchery subyearling fall chinook.

There were five research projects at Lower Granite in 1997 that bypassed fish back to the river. The NMFS Reach Survival Study PIT-tagged and bypassed 16,649 hatchery steelhead. The NMFS Little Goose Project Survival Study bypassed an additional 44,388 PIT-tagged hatchery steelhead. These fish were trucked to release sites above Little Goose Dam. The United States Geological Survey, Biological Research Division (BRD) radio-tagged 168 wild subyearling chinook and released them into the Lower Granite tailrace. The BRD also radio-tagged 231 hatchery and 230 wild steelhead and released them into the Lower Granite forebay for the 1997 spring test of the surface bypass collector. The BRD later radio-tagged 194 wild subyearling chinook for the summer test of the surface bypass collector.

Starting on August 24 and continuing through the end of the collection season, all steelhead were returned to the river to reduce densities for chinook in the mini-tanker. These steelhead were held in the lab until they had recovered from the anesthesia and were then released off the end of the barge dock. A total of 154 hatchery steelhead and 63 wild steelhead were bypassed in this manner.

The PIT tag diversion system was operated to automatically divert all PIT-tagged fish to the river except those designated for transportation and those diverted by the sample system, from March 27 until June 12. During this time, the sub-sample diversion gate overrode the PIT-tag diversion gate and any fish present during a sub-sample went to the sample tank. Approximately 80% of the PIT-tagged hatchery yearling chinook were intentionally sent to raceways for barge transportation for the Fish Passage Center's Hatchery PIT-tag Study. From June 12 on, the PIT-tag diversion system was set to divert all PIT-tagged fish to the river and override the sub-sample diversion gate. When the sample system was switched to 100% sample, all PIT-tagged fish were still diverted back to the river.

PIT-tag database records indicate that the Lower Granite PIT-tag diversion system returned to the river about 59.2% (45,983) of the 77,704 fish detected at Lower Granite. This total includes: 7,182 hatchery yearling chinook, 972 wild yearling chinook, 22,944 hatchery subyearling chinook, 105 wild subyearling chinook, 12,461 hatchery steelhead, 2,170 wild steelhead, 138 hatchery sockeye/kokanee, 11 wild sockeye/kokanee, and three hatchery coho. The PIT-tag diversion system sent 36.6% (28,474) of the PIT-tagged fish to raceways or directly onto barges. Also, 2.3% (1,761) were routed to the sample and 1.8% (1,442) were missed by detectors after initial detection upon exiting the separator. An unknown number of non-tagged fish were also bypassed by the PIT-tag diversion system.

Fish Mortality

Facility/Raceway Mortality

Facility mortality includes fish removed from the raceways and barges or trucks before departure, sample mortalities and post sample mortalities. Mortality rates this year increased from 1996 for all species except wild yearling chinook (Table 17). Hatchery yearling chinook mortality increased 34% from 0.613% in 1996 to 0.933% in 1997. Wild subyearling chinook and hatchery steelhead facility mortality increased 61% and 40%, respectively. We believe the higher mortality rates observed this year reflect the large amounts of debris in the forebay and in the facility for much of the season.

Table 17. Annual percent facility mortality by species at Lower Granite Dam, 1993-1997.

	Yearling Chinook		Subyearling[1] Chinook		Steelhead		Sockeye/Kokanee[2]		Coho[3]	
Year	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Total
1993	0.442	0.326	---	1.251	0.024	0.021	---	2.808	---	0.115
1994	0.420	0.377	---	0.591	0.137	0.054	---	2.920	---	0.228
1995	0.279	0.234	0.291	0.124	0.022	0.015	0.392	1.723	---	0.120
1996	0.613	0.938	0.000	1.418	0.048	0.051	0.000	0.409	0.409	0.135
1997	0.933	0.723	2.196	3.646	0.080	0.074	0.132	2.920	3.950	0.178

[1]Hatchery subyearling chinook were not present until 1997.
[2]Hatchery sockeye/kokanee were not present until 1995.
[3]Hatchery coho were not present until 1996.

Sample mortality

A total of 1,577 smolts were recorded as sample mortalities this season (Appendix A, Table 4). These are fish that were removed from the sample holding tank before and during daily samples during the season. By species, this total includes: 74 hatchery yearling chinook; 30 wild yearling chinook; 768 hatchery subyearling chinook; 245 wild subyearling chinook; 245 hatchery steelhead; 22 wild steelhead; 10 hatchery sockeye/kokanee; 42 wild sockeye/kokanee and 2 hatchery coho.

Mortality rates for sample fish this season were higher for most species than in the previous four years (Table 18). Yearling and subyearling chinook sample mortality rates nearly doubled compared to 1996. We believe the elevated mortality rates observed in the facility this season reflects the high levels of debris in the collection system. Mortality rates in the sample were even higher, an average of four times higher than facility rates. Hatchery steelhead, which made up 62.5% of the season sample total and hatchery subyearling chinook (20.7%), had sample mortality rates 5.1 and 1.8 times higher than in the facility.

We believe that there are at least two reasons for the discrepancy between sample and facility mortality rates. One is the difference in the path that sample fish take to get to the sample holding tank compared to the path taken by fish collected into raceways. Fish collected into raceways pass from the separator through large open flumes where debris is seldom a problem, sample fish are diverted to a headbox where they exit through one of four four-inch counter tunnel pipes into a 10-inch pipe that delivers them to the sample holding tank. The possibility of encountering lodged debris in the sample route is much higher than in the raceway route because of the smaller areas fish pass through.

Second, given existing design of corps raceways, it is difficult for the Corps technicians to recover and accurately enumerate all dead fish, especially during periods with large amounts of debris and fish. Fish that die and sink to the bottom can become mixed with submerged piles of debris and lost when the debris is cleaned from the raceways and dumped over the tail-screen prior to barge or truck loading. Corps raceway technicians strive to recover as many mortalities as possible before transportation, however when workloads for technicians are high, mortality retrieval from raceway debris can be incomplete.

Table 18. Annual percent sample mortality by species at Lower Granite Dam, 1993-1997.

	Yearling Chinook		Subyearling[1] Chinook		Steelhead		Sockeye/Kokanee[2]		Coho[3]	
Year	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Total
1993	2.202	0.308	---	0.847	0.215	0.208	---	5.533	---	0.469
1994	1.772	1.527	---	0.600	0.831	0.453	---	7.231	---	1.097
1995	1.032	0.948	0.676	1.157	0.301	0.129	1.968	3.226	---	0.644
1996	1.861	2.336	0.000	2.708	0.354	0.194	0.000	0.794	0.794	0.785
1997	2.487	3.155	3.889	5.657	0.411	0.447	1.869	6.711	20.588	1.649

[1]Hatchery subyearling chinook were not present until 1997.
[2] Hatchery sockeye/kokanee were not present until 1995
[3]Hatchery coho were not present until 1996.

Research

This year, eight research projects were conducted at the Lower Granite Juvenile Fish Facility. The following descriptions of each project include the number of fish sacrificed or handled. We have listed only research that impacted smolt collection and sampling operations at the juvenile fish facility. Nearly 90,000 fish were impacted in some way by research activities this season. A total of 61,037 hatchery steelhead were PIT-tagged and 627 chinook and 461 steelhead were fitted with radio-tags. Gas bubble examinations were performed on 6,334 fish. Researchers sacrificed 93 hatchery yearling chinook and 128 steelhead. A total of 146 fish were recorded as incidental mortalities of research activities. In addition, 17,134 fish were handled but not used for research purposes.

NMFS Reach Survival Study

The National Marine Fisheries Service (NMFS) conducted a PIT-tagging study of hatchery steelhead to determine survival rates through reservoir reaches below Lower Granite Dam. A total of 16,649 hatchery steelhead were collected and PIT-tagged from April 14 through June 3 for the study. These fish were held in a tank for 24 hours prior to release through the PIT-tag bypass line. An additional 203 hatchery yearling chinook, 41 wild yearling chinook, 1,912 hatchery steelhead, 579 wild steelhead and two wild sockeye were handled. Mortality recorded during the study included 3 hatchery yearling chinook, 48 hatchery steelhead and one wild steelhead.

NMFS Little Goose Project Survival Study

NMFS PIT-tagged hatchery steelhead to determine survival rates of marked fish through the bypass system, turbines and spillways of Little Goose Dam. A total of 44,388 hatchery steelhead were PIT-tagged from April 10 through May 2. The tagged fish were trucked to release sites above Little Goose Dam. These fish were recorded as bypassed at Lower Granite Dam. An additional 2,772 hatchery yearling chinook, 926 wild yearling chinook, 2,870 hatchery steelhead, 4,881 wild steelhead and 23 wild sockeye were handled. Mortality recorded during the study included five hatchery yearling chinook, one wild yearling chinook, and 65 hatchery steelhead.

USGS BRD Little Goose Radio Telemetry Study

The United States Geological Survey Biological Research Division (USGS BRD) surgically inserted radio tags into 168 hatchery subyearling chinook to determine migrational aspects of fish approaching Little Goose Dam. These fish were collected and tagged from July 13 through August 5, held in raceways for 24 hours after tag insertion, and then released into the tailrace of Lower Granite Dam. An additional 36 wild subyearling chinook were handled and released. Researchers reported eight wild subyearling chinook mortalities.

USGS BRD Surface Bypass Collector Analysis Study – Spring

The USGS BRD also used radio-tags to assess the movement of steelhead as they approach the surface bypass collector (SBC) at Lower Granite Dam. A total of 231 hatchery and 230 wild steelhead were tagged from 9 May through 20 May. Study fish were held for 24 hours after tagging in raceways, and released upstream from Lower Granite Dam for tracking. An additional 40 hatchery steelhead and 16 wild steelhead were handled but not tagged. Two wild steelhead were reported as mortalities during the study.

USGS BRD Surface Bypass Collector Analysis Study - Summer

The USGS BRD used radio-tags to assess movement of wild subyearling fall chinook as they approach the SBC at Lower Granite. A total of 194 subyearling chinook were tagged from 14 July through 27 July. Study fish were held for 24 hours in raceways, and then released 12 miles upstream from Lower Granite Dam for tracking through the surface bypass collector. An additional 56 wild subyearling chinook were handled but not tagged. Nine wild subyearling chinook mortalities were reported during the study.

Oregon State University (OSU) Evaluation of Migration and Survival Following Transportation

The Oregon State University Cooperative Fishery Research Unit (OSUCFRU) used radio tags in hatchery yearling chinook to assess migrational characteristics and survival of fish following release from transportation barges below Bonneville Dam. A total of 265 hatchery yearling chinook were surgically radio-tagged from 20 April through 30 May. Study fish were collected from the wet separator at Lower Granite Dam. Tagged fish were transported by barge and released below Bonneville Dam, then tracked to the estuary to examine migration behavior and survival. Researchers reported four hatchery yearling chinook mortalities during the study. An additional 93 hatchery yearling chinook collected from the wet separator were sacrificed to assess physiological indices of fish during the study.

University of Idaho Evaluation of Effects of Descaling on Steelhead Study

The University of Idaho Cooperative Fishery Research Unit (UICFRU) sacrificed 128 steelhead to evaluate the effects of descaling on physiological indices of hatchery and wild steelhead. A total of 64 hatchery and 64 wild steelhead were taken from the daily sample on 28 April. Descaled fish were selected to account for half of each group. On four dates between 28 April and 12 May, 16 hatchery and 16 wild steelhead were examined for wounds and fungus development and sacrificed for blood samples.

Gas Bubble Trauma Monitoring

Exams were performed on fish collected from the wet separator every other day, starting from 7 April through 2 July. The examinations required staff to carefully inspect the unpaired fins, lateral line, and eyes on both sides of the fish with a dissecting microscope for signs of gas bubbles. Up to 100 chinook (hatchery and wild) and up to 100 steelhead (hatchery and wild), depending on the numbers of fish available, were examined each day for GBT symptoms. For the season, a total of 6,334 salmonids were examined. This total included 1,788 hatchery yearling chinook, 301 wild yearling chinook, 3,844 hatchery steelhead, and 401 wild steelhead. There were 77 fish observed with symptoms of GBT; 3 had some bubbles in the caudal fin; 12 had some bubbles in the anal fin; 2 fish exhibited bubbles in the eye, and 60 had lateral line occlusions. Almost all of the reported symptoms resulted from single small bubbles. No mortalities occurred from handling during examinations.

Recommendations

Construct 10" bypass line from the separator to the sample tank that would bypass the sample headbox tank and 4-inch counter tunnels during periods of 100% sample – to reduce stress, descaling and mortality.

Construct a small holding tank inside the sample room that would allow for recovery and subsequent direct bypass of smolts and non-salmonid fishes back to the river. Currently, non-salmonids are taken directly from the sorting tank and bypassed without time to recover from anesthesia. Smolts are placed in fresh water buckets, allowed to recover, and dumped off the barge dock.

These recommendations have been submitted to the Corps for consideration and implementation.

Appendix

Appendix A

Table 1: Daily collection by species and total flows, spill and water temperature at Lower Granite Dam, 1997.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		Daily	Cumulative	River	Spill	Temp.
Date	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total	Total	(kcfs)	(kcfs)	(F)
3/27/97	0	20	0	0	50	90	0	0	10	170	170	124.9	19.9	46.4
3/28/97	0	0	0	0	270	400	0	0	0	670	840	141.5	30.4	46.4
3/29/97	0	10	0	0	890	900	0	0	0	1,800	2,640	140.7	27.1	46.4
3/30/97	0	20	0	0	1,580	1,790	0	0	0	3,390	6,030	136.4	17.8	46.4
3/31/97	10	110	0	0	2,550	1,630	0	0	0	4,300	10,330	119.1	14.7	47.3
4/1/97	0	40	0	0	1,480	930	0	0	10	2,460	12,790	119.1	16.7	47.3
4/2/97	0	70	0	0	2,880	2,060	0	0	20	5,030	17,820	110.4	15.0	47.3
4/3/97	0	180	0	0	4,920	2,040	0	0	0	7,140	24,960	100.8	3.1	47.3
4/4/97	20	180	0	0	4,800	1,860	0	0	0	6,860	31,820	99.1	0.0	47.3
4/5/97	0	180	0	0	3,220	1,420	0	0	0	4,820	36,640	88.5	0.0	47.3
4/6/97	40	680	0	20	5,920	2,180	0	0	0	8,840	45,480	86.8	0.0	47.3
4/7/97	60	380	0	60	9,220	1,660	0	0	0	11,380	56,860	77.7	0.0	47.3
4/8/97	40	540	0	20	26,453	1,427	0	0	20	28,500	85,360	85.7	0.0	48.2
4/9/97	100	850	0	0	46,600	2,500	0	0	0	50,050	135,410	86.7	0.0	48.2
4/10/97	100	800	0	0	22,096	904	0	0	0	23,900	159,310	86.1	0.0	48.2
4/11/97	200	1,350	0	0	14,450	1,500	0	0	0	17,500	176,810	93.0	22.2	48.2
4/12/97	200	1,200	0	0	19,542	2,008	0	0	0	22,950	199,760	84.3	22.3	48.2
4/13/97	450	800	0	0	12,200	1,150	0	0	0	14,600	214,360	83.1	22.2	48.2
4/14/97	450	1,400	0	0	33,094	1,556	0	0	50	36,550	250,910	79.9	22.2	48.2
4/15/97	350	2,000	0	0	29,650	1,550	0	0	50	33,600	284,510	85.2	22.1	48.2
4/16/97	300	850	0	0	11,998	652	0	0	0	13,800	298,310	88.2	27.9	48.2
4/17/97	750	1,250	0	0	16,750	1,050	0	0	0	19,800	318,110	96.3	25.3	48.2
4/18/97	3,018	1,414	0	0	23,946	1,904	0	0	0	30,282	348,392	109.5	28.3	48.2
4/19/97	4,900	1,350	0	0	13,700	2,450	0	0	0	22,400	370,792	113.5	28.2	48.2
4/20/97	10,978	2,322	0	0	15,736	3,964	0	0	50	33,050	403,842	129.1	30.2	48.2
4/21/97	11,700	1,100	0	0	72,950	13,850	0	0	50	99,650	503,492	167.6	44.3	48.2
4/22/97	13,070	5,730	0	0	137,979	27,821	0	0	400	185,000	688,492	181.3	56.1	48.2
4/23/97	8,100	4,400	0	0	103,200	12,700	0	0	0	128,400	816,892	174.8	47.7	48.2
4/24/97	4,166	1,834	0	0	90,077	14,623	0	0	0	110,700	927,592	177.1	54.9	49.1
4/25/97	5,400	2,400	0	0	122,100	14,200	0	0	100	144,200	1,071,792	177.4	60.0	49.1
4/26/97	5,274	2,626	0	0	91,480	7,220	0	0	100	106,700	1,178,492	167.2	50.6	49.1

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Table 1: Daily collection by species and total flows, spill and water temperature at Lower Granite Dam, 1997.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		Daily	Cumulative	River	Spill	Temp.
Date	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total	Total	(kcfs)	(kcfs)	(F)
4/27/97	4,300	1,000	0	0	54,100	3,700	0	0	200	63,300	1,241,792	158.5	57.5	50.0
4/28/97	5,982	1,918	0	0	108,386	7,214	0	0	0	123,500	1,365,292	166.3	47.7	50.9
4/29/97	7,800	1,000	0	100	146,800	9,800	0	0	0	165,500	1,530,792	175.3	50.0	50.9
4/30/97	5,083	917	0	0	134,074	6,526	0	0	0	146,600	1,677,392	178.4	59.4	50.0
5/1/97	9,150	1,650	0	0	202,500	6,450	0	0	0	219,750	1,897,142	171.8	49.0	50.0
5/2/97	5,040	1,210	0	0	250,146	4,804	0	0	150	261,350	2,158,492	167.6	56.0	50.0
5/3/97	6,150	450	0	0	135,000	3,150	0	0	0	144,750	2,303,242	149.3	46.2	50.0
5/7/97	4,200	150	0	0	137,400	5,850	0	0	0	147,600	2,886,392	147.0	28.9	51.8
5/8/97	6,093	1,057	0	0	126,540	8,260	0	0	0	141,950	3,028,342	152.7	37.1	51.8
5/9/97	4,200	450	0	0	91,800	7,200	0	0	0	103,650	3,131,992	152.2	38.9	51.8
5/10/97	3,090	310	0	0	134,942	8,858	0	0	150	147,350	3,279,342	149.8	41.3	51.8
5/11/97	3,300	900	0	0	94,050	10,500	0	0	0	108,750	3,388,092	161.9	48.6	51.8
5/12/97	6,685	1,215	0	0	67,122	7,528	0	0	0	82,550	3,470,642	164.1	62.7	52.7
5/13/97	8,250	1,200	0	0	93,450	8,700	0	0	0	111,600	3,582,242	165.8	59.0	53.6
5/14/97	7,141	909	0	0	137,028	12,772	0	0	150	158,000	3,740,242	175.6	64.9	52.7
5/15/97	6,450	600	0	0	79,950	7,050	0	0	0	94,050	3,834,292	191.9	92.1	52.7
5/16/97	5,341	309	0	150	71,042	5,108	0	0	0	81,950	3,916,242	203.5	78.8	51.8
5/17/97	6,150	600	0	300	39,300	4,200	0	0	150	50,700	3,966,942	216.6	91.9	52.7
5/18/97	5,289	711	0	0	56,883	4,417	100	0	0	67,400	4,034,342	225.8	103.2	52.7
5/19/97	3,600	500	0	0	30,200	2,900	0	0	100	37,300	4,071,642	222.5	97.5	51.8
5/20/97	2,696	304	0	0	27,640	2,110	50	0	0	32,800	4,104,442	201.4	86.5	51.8
5/21/97	1,100	300	0	0	33,850	2,450	50	0	0	37,750	4,142,192	200.5	86.7	51.8
5/22/97	1,679	71	0	150	27,435	2,315	50	0	50	31,750	4,173,942	185.6	64.9	52.7
5/23/97	1,050	250	0	50	29,900	1,600	0	0	0	32,850	4,206,792	178.6	71.4	52.7
5/24/97	1,440	151	0	0	57,495	2,155	0	0	0	61,241	4,268,033	170.4	56.5	53.6
5/25/97	700	50	0	50	27,150	1,300	0	0	100	29,350	4,297,383	171.0	75.1	53.6
5/26/97	846	104	0	0	16,949	651	0	0	0	18,550	4,315,933	159.8	66.0	52.7
5/27/97	1,550	100	0	50	24,600	550	150	0	50	27,050	4,342,983	149.9	46.4	52.7
5/28/97	391	125	0	20	15,600	720	0	0	20	16,876	4,359,859	146.0	37.5	53.6
5/29/97	460	40	0	0	13,840	520	0	0	20	14,880	4,374,739	141.1	36.4	53.6

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Table 1: Daily collection by species and total flows, spill and water temperature at Lower Granite Dam, 1997.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		Daily	Cumulative	River	Spill	Temp.
Date	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total	Total	(kcfs)	(kcfs)	(F)
5/30/97	596	61	0	0	16,697	823	100	0	40	18,317	4,393,056	145.7	43.9	55.4
5/31/97	620	20	0	40	15,820	880	140	0	20	17,540	4,410,596	152.7	44.5	55.4
6/1/97	694	61	0	20	23,369	1,191	40	0	60	25,435	4,436,031	168.1	59.8	54.3
6/2/97	1,460	260	0	20	31,760	1,280	100	0	0	34,880	4,470,911	185.1	69.9	53.7
6/3/97	851	203	0	0	25,197	923	40	0	0	27,214	4,498,125	191.7	77.7	54.5
6/4/97	300	50	0	0	8,325	400	25	0	0	9,100	4,507,225	180.7	63.2	54.5
6/5/97	294	75	0	0	4,790	235	100	0	0	5,494	4,512,719	178.2	83.3	53.6
6/6/97	380	80	0	40	7,700	360	60	0	0	8,620	4,521,339	187.5	83.7	53.6
6/7/97	265	0	0	0	5,716	244	20	0	0	6,245	4,527,584	184.9	83.9	53.6
6/8/97	140	40	0	20	3,580	280	20	0	0	4,080	4,531,664	175.8	84.0	53.6
6/9/97	71	42	0	0	2,622	98	10	0	20	2,863	4,534,527	173.0	93.1	55.4
6/10/97	250	50	0	0	2,590	120	40	0	0	3,050	4,537,577	171.0	70.3	57.2
6/11/97	286	51	0	10	2,997	123	30	0	0	3,497	4,541,074	176.0	83.1	57.2
6/12/97	100	50	0	0	2,020	110	40	0	0	2,320	4,543,394	183.5	92.0	57.2
6/13/97	217	12	50	20	2,871	129	30	0	10	3,339	4,546,733	192.9	89.1	56.3
6/14/97	222	42	30	54	3,756	96	18	0	0	4,218	4,550,951	185.9	91.6	55.4
6/18/97	150	42	330	84	2,904	54	12	0	18	3,594	4,563,978	182.5	91.2	59.0
6/19/97	150	54	348	48	3,773	35	6	0	12	4,426	4,568,404	178.4	67.9	59.0
6/20/97	180	24	342	132	2,676	42	12	0	12	3,420	4,571,824	174.1	65.7	59.0
6/21/97	84	12	546	162	2,695	81	6	0	12	3,598	4,575,422	167.7	70.0	59.9
6/22/97	156	24	270	78	1,872	126	12	0	60	2,598	4,578,020	155.9	59.7	60.8
6/23/97	36	0	690	186	1,350	109	0	0	36	2,407	4,580,427	146.8	51.1	59.9
6/24/97	78	24	624	168	2,100	66	0	0	42	3,102	4,583,529	134.2	37.0	60.8
6/25/97	30	12	1,092	306	1,167	43	18	0	30	2,698	4,586,227	118.6	11.1	60.8
6/26/97	18	6	792	258	1,128	30	36	0	48	2,316	4,588,543	102.4	0.0	62.6
6/27/97	30	6	870	138	1,423	19	6	0	6	2,498	4,591,041	106.7	7.4	62.6
6/28/97	30	6	498	144	1,116	18	6	0	24	1,842	4,592,883	107.5	11.7	62.6
6/29/97	54	12	540	162	1,428	33	0	0	24	2,253	4,595,136	108.4	2.2	62.6
6/30/97	48	0	612	174	1,068	18	6	0	30	1,956	4,597,092	106.9	2.8	63.5
7/1/97	30	0	888	162	1,399	27	12	0	36	2,554	4,599,646	102.5	0.0	63.5
7/2/97	54	6	1,902	480	1,146	42	12	0	48	3,690	4,603,336	104.0	1.7	64.4

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Table 1: Daily collection by species and total flows, spill and water temperature at Lower Granite Dam, 1997.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		Daily	Cumulative	River	Spill	Temp.
Date	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total	Total	(kcfs)	(kcfs)	(F)
7/3/97	42	0	1,332	360	1,410	29	6	0	12	3,191	4,606,527	101.3	6.0	64.4
7/4/97	30	6	468	216	1,950	6	36	0	24	2,736	4,609,263	95.0	5.9	62.6
7/5/97	36	0	984	168	2,370	12	6	0	12	3,588	4,612,851	88.8	6.0	62.6
7/6/97	12	0	732	126	1,578	24	6	0	6	2,484	4,615,335	83.8	5.9	63.1
7/7/97	6	0	750	288	906	12	0	0	12	1,974	4,617,309	78.9	0.0	62.5
7/8/97	12	0	1,608	288	744	18	12	0	12	2,694	4,620,003	75.1	0.0	64.4
7/9/97	6	0	2,184	444	462	12	0	12	18	3,138	4,623,141	69.2	2.8	65.3
7/10/97	6	0	2,184	330	366	6	12	12	12	2,928	4,626,069	69.7	0.0	66.2
7/11/97	12	12	1,956	420	840	12	0	0	6	3,258	4,629,327	73.7	0.0	66.2
7/12/97	0	6	1,476	192	570	12	6	6	0	2,268	4,631,595	65.4	5.9	66.2
7/13/97	0	0	1,248	216	276	0	0	0	12	1,752	4,633,347	56.1	0.0	66.2
7/14/97	0	0	1,272	282	216	0	6	0	18	1,794	4,635,141	53.6	5.9	64.4
7/15/97	0	0	1,056	304	352	0	0	8	12	1,732	4,636,873	50.0	0.0	64.4
7/16/97	0	0	968	160	340	12	0	0	4	1,484	4,638,357	70.3	9.0	65.3
7/17/97	0	12	2,340	364	584	8	4	24	4	3,340	4,641,697	64.5	5.9	66.2
7/18/97	24	0	2,876	380	948	32	0	12	4	4,276	4,645,973	65.6	5.7	66.2
7/19/97	0	0	2,376	396	684	54	0	0	12	3,522	4,649,495	62.4	1.2	66.2
7/20/97	0	0	2,532	318	180	54	0	0	24	3,108	4,652,603	65.4	0.0	66.2
7/21/97	0	0	2,010	348	264	0	0	0	0	2,622	4,655,225	65.8	4.4	66.2
7/22/97	6	0	1,590	372	306	0	0	6	6	2,286	4,657,511	62.9	0.2	66.2
7/23/97	0	0	930	120	438	0	0	24	12	1,524	4,659,035	64.2	5.9	66.2
7/24/97	0	0	996	180	252	6	0	6	12	1,452	4,660,487	59.9	5.8	66.2
7/28/97	0	0	1,344	92	148	0	0	16	0	1,600	4,667,907	60.4	6.0	67.1
7/29/97	0	0	952	128	132	0	0	12	0	1,224	4,669,131	59.5	5.5	67.1
7/30/97	0	0	888	112	96	4	0	0	4	1,104	4,670,235	57.2	0.0	67.1
7/31/97	0	0	1,024	112	104	0	0	12	4	1,256	4,671,491	56.9	5.6	67.1
8/1/97	0	0	1,300	204	80	0	0	12	4	1,600	4,673,091	58.6	0.0	67.1
8/2/97	0	0	1,280	108	136	32	0	12	4	1,572	4,674,663	58.4	0.0	67.1
8/3/97	4	0	924	88	108	12	0	4	0	1,140	4,675,803	56.7	0.0	67.1
8/4/97	0	0	588	60	88	12	0	4	12	764	4,676,567	54.5	0.0	67.1
8/5/97	0	0	772	64	104	0	0	8	0	948	4,677,515	55.3	0.0	68.0

Appendix A

Table 1: Daily collection by species and total flows, spill and water temperature at Lower Granite Dam, 1997.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		Daily	Cumulative	River	Spill	Temp.
Date	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total	Total	(kcfs)	(kcfs)	(F)
8/6/97	0	0	832	104	112	0	0	8	0	1,056	4,678,571	55.3	0.0	68.9
8/7/97	0	0	756	92	124	8	0	4	4	988	4,679,559	54.2	0.0	68.0
8/8/97	0	0	652	88	128	0	0	4	0	872	4,680,431	53.4	7.7	68.0
8/9/97	0	0	692	84	100	0	0	12	0	888	4,681,319	50.7	0.0	68.0
8/10/97	0	0	580	48	92	0	0	12	0	732	4,682,051	52.0	0.0	68.0
8/11/97	0	0	644	100	128	4	0	4	4	884	4,682,935	51.2	0.0	68.0
8/12/97	0	0	488	72	64	0	0	4	0	628	4,683,563	50.5	0.0	68.0
8/13/97	0	0	516	108	48	0	0	0	0	672	4,684,235	49.8	0.0	68.0
8/14/97	0	0	568	108	92	8	0	0	0	776	4,685,011	51.9	0.0	68.0
8/15/97	0	0	476	140	60	8	0	0	0	684	4,685,695	51.2	0.0	68.0
8/16/97	0	0	472	72	64	16	0	4	0	628	4,686,323	48.7	0.0	68.0
8/17/97	0	0	384	40	104	20	0	8	0	556	4,686,879	44.6	0.0	66.2
8/18/97	0	0	308	104	132	4	0	8	4	560	4,687,439	41.8	0.0	67.1
8/19/97	0	0	204	40	156	8	0	8	0	416	4,687,855	43.3	0.0	68.0
8/20/97	0	0	272	80	68	0	0	0	4	424	4,688,279	42.4	0.0	68.0
8/21/97	0	0	172	40	72	0	0	0	0	284	4,688,563	41.2	0.0	68.0
8/22/97	0	0	184	28	48	0	0	4	4	268	4,688,831	40.7	0.0	68.9
8/23/97	0	0	404	76	32	8	0	0	0	520	4,689,351	41.7	0.0	69.8
8/24/97	0	0	403	93	76	5	0	2	2	581	4,689,932	41.5	0.0	69.8
8/25/97	0	0	319	63	31	0	0	1	0	414	4,690,346	42.2	0.0	69.8
8/26/97	0	0	246	77	23	2	0	3	2	353	4,690,699	43.7	0.0	69.8
8/27/97	0	0	198	62	24	4	0	1	4	293	4,690,992	42.3	0.0	69.8
8/28/97	0	0	197	60	18	4	0	2	3	284	4,691,276	41.3	0.0	68.9
8/29/97	0	0	213	70	5	0	0	0	0	288	4,691,564	33.9	0.0	68.9
8/30/97	0	0	160	53	4	2	0	1	2	222	4,691,786	30.1	0.0	68.9
8/31/97	0	0	175	46	10	5	0	0	0	236	4,692,022	29.4	0.0	69.8
9/1/97	0	0	112	52	10	1	0	1	2	178	4,692,200	29.4	0.0	69.8
9/2/97	0	0	156	53	13	0	0	2	0	224	4,692,424	28.0	0.0	69.8
9/3/97	0	0	170	70	13	1	0	1	0	255	4,692,679	29.5	0.0	70.7
9/4/97	0	0	204	82	8	3	0	1	0	298	4,692,977	29.7	0.0	71.6
9/8/97	0	0	133	106	7	0	0	0	0	246	4,694,182	28.4	0.0	71.6

Appendix A

Table 1: Daily collection by species and total flows, spill and water temperature at Lower Granite Dam, 1997.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		Daily	Cumulative	River	Spill	Temp.
Date	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total	Total	(kcfs)	(kcfs)	(F)
9/9/97	0	0	131	105	4	4	0	0	0	244	4,694,426	30.8	0.9	71.6
9/10/97	0	0	158	107	2	0	0	0	1	268	4,694,694	30.4	11.5	71.6
9/11/97	0	1	140	92	6	1	0	1	1	242	4,694,936	27.4	9.8	71.6
9/12/97	0	1	120	111	6	0	0	0	1	239	4,695,175	27.2	0.0	71.6
9/13/97	0	1	69	58	4	0	0	1	2	135	4,695,310	29.9	0.0	71.6
9/14/97	0	1	99	98	2	0	0	1	0	201	4,695,511	30.0	0.0	71.6
9/15/97	0	0	153	110	6	0	0	0	0	269	4,695,780	34.1	0.0	70.7
9/16/97	0	0	127	146	3	0	0	0	1	277	4,696,057	34.4	0.0	70.7
9/17/97	0	0	138	201	2	1	0	1	0	343	4,696,400	40.5	0.0	69.8
9/18/97	0	0	181	254	3	1	0	1	1	441	4,696,841	44.4	0.0	69.8
9/19/97	0	0	209	277	7	0	0	0	0	493	4,697,334	39.7	0.0	68.9
9/20/97	0	0	168	211	7	1	0	0	1	388	4,697,722	41.1	0.0	68.0
9/21/97	0	0	109	146	7	4	0	1	0	267	4,697,989	40.2	0.0	67.1
9/22/97	0	0	111	160	3	0	0	0	0	274	4,698,263	40.1	0.0	67.1
9/23/97	0	0	100	170	3	0	0	1	0	274	4,698,537	41.4	0.0	67.1
9/24/97	0	0	86	153	1	2	0	1	0	243	4,698,780	38.0	2.6	67.1
9/25/97	0	0	83	108	2	6	0	3	1	203	4,698,983	46.4	0.0	67.1
9/26/97	0	0	79	100	2	2	0	0	1	184	4,699,167	41.0	0.0	67.1
9/27/97	0	0	39	46	5	4	0	1	0	95	4,699,262	41.6	0.0	67.1
9/28/97	0	0	40	52	2	9	0	5	0	108	4,699,370	40.5	0.0	67.1
9/29/97	0	0	68	67	2	1	0	2	2	142	4,699,512	43.1	0.0	67.1
9/30/97	0	0	67	51	2	1	0	7	0	128	4,699,640	41.6	0.0	67.1
10/1/97	0	0	27	28	1	1	0	1	0	58	4,699,698	41.7	0.0	67.1
10/2/97	0	0	30	40	0	0	0	1	0	71	4,699,769	41.6	0.0	66.2
10/3/97	0	0	36	28	0	0	0	0	1	65	4,699,834	39.7	0.0	65.3
10/4/97	0	0	20	20	0	0	0	1	1	42	4,699,876	38.3	0.0	64.4
10/5/97	0	0	14	27	0	1	0	0	0	42	4,699,918	40.6	0.0	64.4
10/6/97	0	0	22	14	1	1	0	3	1	42	4,699,960	38.6	0.0	64.4
10/7/97	0	0	12	9	0	0	0	0	0	21	4,699,981	42.9	0.0	63.5
10/8/97	0	0	12	6	1	1	0	1	0	21	4,700,002	43.1	0.0	62.6
10/9/97	0	0	14	10	1	1	0	1	0	27	4,700,029	42.6	0.0	61.7

Appendix A

Table 1: Daily collection by species and total flows, spill and water temperature at Lower Granite Dam, 1997.

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		Daily	Cumulative	River	Spill	Temp.
Date	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total	Total	(kcfs)	(kcfs)	(F)
10/10/97	0	0	13	16	0	0	0	0	0	29	4,700,058	39.8	0.0	61.7
10/11/97	0	0	15	8	1	0	0	2	0	26	4,700,084	41.7	0.0	60.8
10/12/97	0	0	12	5	0	0	0	0	0	17	4,700,101	42.3	0.0	59.9
10/13/97	0	0	10	6	1	0	0	1	0	18	4,700,119	43.1	0.0	59.0
10/14/97	0	0	8	4	4	0	0	1	0	17	4,700,136	40.8	0.0	59.0
10/15/97	0	0	8	5	0	0	0	2	0	15	4,700,151	46.7	0.0	58.6
10/16/97	0	0	7	5	0	0	0	2	1	15	4,700,166	48.7	0.0	58.6
10/20/97	0	0	10	7	1	2	0	1	0	21	4,700,229	36.5	0.0	59.0
10/21/97	0	0	5	9	1	1	0	0	0	16	4,700,245	21.2	0.0	59.9
10/22/97	0	0	1	2	0	1	0	0	0	4	4,700,249	22.2	0.0	59.0
10/23/97	0	0	2	3	1	1	0	1	0	8	4,700,257	22.7	0.0	57.2
10/24/97	0	0	4	0	0	0	0	0	0	4	4,700,261	21.6	0.0	57.0
10/25/97	0	0	3	0	1	1	0	0	0	5	4,700,266	22.0	0.0	57.0
10/26/97	0	0	1	2	0	1	0	0	0	4	4,700,270	21.0	0.0	56.5
10/27/97	0	0	2	1	0	0	0	0	0	3	4,700,273	22.1	0.0	55.4
10/28/97	0	0	3	3	0	1	0	0	0	7	4,700,280	22.6	0.0	55.4
10/29/97	0	0	6	3	2	0	0	0	0	11	4,700,291	21.6	0.0	53.6
10/30/97	0	0	1	3	0	0	0	2	1	7	4,700,298	22.9	0.0	53.6
10/31/97	0	0	2	0	0	1	0	0	0	3	4,700,301	29.1	0.0	53.6
11/1/97	0	0	4	14	2	1	0	2	1	24	4,700,325	39.8	0.0	53.6
Total	202,952	56,002	67,433	16,528	3,613,005	287,914	1,451	333	2,903	4,248,521				

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Table 2: Daily bypass totals at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Date	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
3/27/97	0	0	0	0	0	0	0	0	0	0
3/28/97	0	0	0	0	0	0	0	0	0	0
3/29/97	0	0	0	0	0	0	0	0	0	0
3/30/97	0	0	0	0	0	0	0	0	0	0
3/31/97	0	0	0	0	0	0	0	0	0	0
4/1/97	0	0	0	0	0	0	0	0	0	0
4/2/97	0	0	0	0	0	0	0	0	0	0
4/3/97	0	0	0	0	0	0	0	0	0	0
4/4/97	0	0	0	0	0	0	0	0	0	0
4/5/97	0	0	0	0	0	0	0	0	0	0
4/6/97	0	0	0	0	0	0	0	0	0	0
4/7/97	0	0	0	0	0	0	0	0	0	0
4/8/97	2	26	0	1	1,316	71	0	0	0	1,416
4/9/97	87	742	0	0	40,679	2,182	0	0	0	43,690
4/10/97	0	0	0	0	211	0	0	0	0	211
4/11/97	0	0	0	0	0	0	0	0	0	0
4/12/97	0	0	0	0	0	0	0	0	0	0
4/13/97	0	0	0	0	0	0	0	0	0	0
4/14/97	0	0	0	0	0	0	0	0	0	0
4/15/97	0	0	0	0	3,218	0	0	0	0	3,218
4/16/97	0	0	0	0	2,937	0	0	0	0	2,937
4/17/97	0	0	0	0	2,761	0	0	0	0	2,761
4/18/97	0	0	0	0	2,756	0	0	0	0	2,756
4/19/97	0	0	0	0	2,153	0	0	0	0	2,153
4/20/97	0	0	0	0	2,211	0	0	0	0	2,211
4/21/97	0	0	0	0	2,710	0	0	0	0	2,710
4/22/97	0	0	0	0	2,002	0	0	0	0	2,002
4/23/97	0	0	0	0	3,350	0	0	0	0	3,350
4/24/97	0	0	0	0	3,354	0	0	0	0	3,354
4/25/97	0	0	0	0	3,300	0	0	0	0	3,300

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
0	0	0	0	0	1	0	0	1	2
0	0	0	0	0	0	0	0	0	0
0	0	0	0	4	1	0	0	0	5
0	0	0	0	11	0	0	0	0	11
0	0	0	0	2	0	0	0	0	2
0	1	0	0	10	0	0	0	0	11
0	0	0	0	6	0	0	0	0	6
0	0	0	0	11	1	0	0	0	12
1	0	0	0	3	0	0	0	0	4
0	0	0	0	9	1	0	0	0	10
0	3	0	0	5	0	0	0	0	8
1	1	0	1	10	4	0	0	0	17
1	2	0	1	11	3	0	0	3	21
1	2	0	0	13	6	0	0	0	22
0	5	0	0	4	0	0	0	0	9
0	5	0	0	19	3	0	0	0	27
0	4	0	0	9	1	0	0	0	14
0	19	0	0	13	0	0	0	0	32
1	5	0	0	7	0	0	0	1	14
5	6	0	0	5	0	0	0	2	18
3	10	0	0	10	0	0	0	0	23
0	6	0	0	10	1	0	0	0	17
19	15	0	0	30	1	0	0	0	65
26	2	0	0	68	11	0	0	0	107
16	18	0	0	45	17	0	0	3	99
109	16	0	0	44	2	0	0	8	179
65	22	0	0	49	4	0	0	20	160
112	38	0	0	116	10	0	0	0	276
38	39	0	0	66	0	0	0	0	143
34	5	0	0	37	0	0	0	1	77

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Table 2: Daily bypass totals at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Date	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
4/26/97	0	0	0	0	3,345	0	0	0	0	3,345
4/27/97	0	0	0	0	2,707	0	0	0	0	2,707
4/28/97	0	0	0	0	2,600	0	0	0	0	2,600
4/29/97	0	0	0	0	3,574	0	0	0	0	3,574
4/30/97	0	0	0	0	2,600	0	0	0	0	2,600
5/1/97	0	0	0	0	2,600	0	0	0	0	2,600
5/2/97	0	0	0	0	1,002	0	0	0	0	1,002
5/3/97	0	0	0	0	1,400	0	0	0	0	1,400
5/4/97	0	0	0	0	0	0	0	0	0	0
5/5/97	0	0	0	0	0	0	0	0	0	0
5/6/97	0	0	0	0	953	0	0	0	0	953
5/7/97	0	0	0	0	945	0	0	0	0	945
5/8/97	0	0	0	0	950	0	0	0	0	950
5/9/97	0	0	0	0	952	0	0	0	0	952
5/10/97	0	0	0	0	981	0	0	0	0	981
5/11/97	0	0	0	0	0	0	0	0	0	0
5/12/97	0	0	0	0	0	0	0	0	0	0
5/13/97	0	0	0	0	780	30	0	0	0	810
5/14/97	0	0	0	0	751	30	0	0	0	781
5/15/97	0	0	0	0	751	0	0	0	0	751
5/16/97	0	0	0	0	872	106	0	0	0	978
5/17/97	0	0	0	0	750	0	0	0	0	750
5/18/97	0	0	0	0	0	0	0	0	0	0
5/19/97	0	0	0	0	200	0	0	0	0	200
5/20/97	3	0	0	0	230	29	0	0	0	262
5/21/97	0	0	0	0	200	0	0	0	0	200
5/22/97	0	0	0	0	200	0	0	0	0	200
5/23/97	0	0	0	0	195	0	0	0	0	195
5/24/97	0	0	0	0	0	0	0	0	0	0
5/25/97	0	0	0	0	0	0	0	0	0	0
5/26/97	0	0	0	0	100	0	0	0	0	100

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
	41	9	0	0	78	3	0	0	3	134
	36	3	0	0	43	2	0	0	2	86
	30	0	0	0	21	1	0	0	0	52
	32	6	0	0	40	4	0	0	0	82
	24	9	0	0	29	0	0	0	0	62
	94	16	0	0	35	1	0	0	0	146
	173	29	0	0	114	7	0	0	8	331
	78	18	0	0	184	0	0	0	0	280
	185	6	0	0	270	2	0	0	0	463
	92	8	0	0	288	13	0	0	0	401
	68	10	0	0	60	0	0	0	0	138
	168	14	0	0	61	0	0	0	0	243
	81	12	0	0	42	2	0	0	0	137
	14	0	0	0	56	1	0	0	0	71
	13	2	0	0	37	0	0	0	5	57
	12	2	0	0	31	0	0	0	0	45
	34	2	0	0	61	0	0	0	0	97
	32	5	0	0	79	3	0	0	0	119
	37	7	0	0	109	1	0	0	1	155
	40	2	0	0	59	0	0	0	0	101
	10	1	0	0	31	0	0	0	0	42
	25	1	0	0	20	0	0	0	0	46
	23	1	0	0	16	3	0	0	0	43
	33	10	0	0	127	10	0	0	0	180
	12	0	0	0	9	0	0	0	0	21
	8	1	0	0	12	0	0	0	0	21
	12	0	0	1	7	0	0	0	0	20
	18	0	0	0	13	1	0	0	0	32
	2	1	0	0	27	0	0	0	0	30
	11	0	0	0	31	0	0	0	0	42
	1	0	0	0	11	0	0	0	0	12

Appendix A

Table 2: Daily bypass totals at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Date	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
5/27/97	0	0	0	0	102	0	0	0	0	102
5/28/97	0	0	0	0	150	36	0	0	0	186
5/29/97	0	0	0	0	102	12	0	0	0	114
5/30/97	0	0	0	0	101	0	0	0	0	101
5/31/97	0	0	0	0	0	0	0	0	0	0
6/1/97	0	0	0	0	0	0	0	0	0	0
6/2/97	0	0	0	0	99	0	0	0	0	99
6/3/97	0	0	0	0	142	0	0	0	0	142
6/4/97	0	0	0	0	0	0	0	0	0	0
6/5/97	0	0	0	0	0	0	0	0	0	0
6/6/97	0	0	0	0	0	0	0	0	0	0
6/7/97	0	0	0	0	0	0	0	0	0	0
6/8/97	0	0	0	0	0	0	0	0	0	0
6/9/97	315	19	0	10	7,155	366	29	0	0	7,894
6/10/97	0	0	0	0	0	0	0	0	0	0
6/11/97	0	0	0	0	0	0	0	0	0	0
6/12/97	0	0	0	0	0	0	0	0	0	0
6/13/97	0	0	0	0	0	0	0	0	0	0
6/14/97	0	0	0	0	0	0	0	0	0	0
6/15/97	0	0	0	0	0	0	0	0	0	0
6/16/97	0	0	0	0	0	0	0	0	0	0
6/17/97	0	0	0	0	0	0	0	0	0	0
6/18/97	0	0	0	0	0	0	0	0	0	0
6/19/97	0	0	0	0	0	0	0	0	0	0
6/20/97	0	0	0	0	0	0	0	0	0	0
6/21/97	0	0	0	0	0	0	0	0	0	0
6/22/97	0	0	0	0	0	0	0	0	0	0
6/23/97	0	0	0	0	0	0	0	0	0	0
6/24/97	0	0	0	0	0	0	0	0	0	0
6/25/97	0	0	0	0	0	0	0	0	0	0
6/26/97	0	0	0	0	0	0	0	0	0	0

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
	4	0	0	0	13	1	0	0	2	20
	1	0	0	0	12	0	0	0	0	13
	0	0	0	0	13	2	0	0	0	15
	5	0	0	0	7	0	0	0	2	14
	10	0	0	0	23	0	0	0	0	33
	0	0	0	0	9	0	0	0	0	9
	8	0	0	0	22	0	0	0	0	30
	5	1	0	0	5	0	0	0	0	11
	8	1	0	0	19	0	0	0	0	28
	1	0	0	0	2	0	0	0	0	3
	0	0	0	1	12	0	0	0	0	13
	3	0	0	0	3	0	0	0	0	6
	2	0	0	0	10	2	0	0	0	14
	0	2	0	0	4	1	0	0	0	7
	1	0	0	0	4	1	0	0	0	6
	2	0	0	0	5	0	0	0	0	7
	0	0	0	0	7	0	0	0	0	7
	5	0	0	0	0	0	0	0	0	5
	7	1	0	0	8	0	0	0	0	16
	7	0	0	0	16	2	0	0	0	25
	2	1	3	0	2	1	0	0	0	9
	3	0	5	0	8	0	0	0	0	16
	6	2	0	0	13	1	0	0	0	22
	4	0	4	1	7	0	0	0	1	17
	3	1	5	2	5	1	0	0	1	18
	0	0	6	2	4	1	0	0	0	13
	3	0	6	2	6	2	0	0	5	24
	0	0	2	4	3	3	0	0	2	14
	1	1	10	5	15	3	0	0	6	41
	3	0	14	4	4	0	0	0	2	27
	0	0	10	7	10	0	0	0	0	27

Appendix A

Table 2: Daily bypass totals at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Date	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
6/27/97	0	0	0	0	0	0	0	0	0	0
6/28/97	0	0	0	0	0	0	0	0	0	0
6/29/97	0	0	0	0	0	0	0	0	0	0
6/30/97	0	0	0	0	0	0	0	0	0	0
7/1/97	0	0	0	0	0	0	0	0	0	0
7/2/97	0	0	0	0	0	0	0	0	0	0
7/3/97	0	0	0	0	0	0	0	0	0	0
7/4/97	0	0	0	0	0	0	0	0	0	0
7/5/97	0	0	0	0	0	0	0	0	0	0
7/6/97	0	0	0	0	0	0	0	0	0	0
7/7/97	0	0	0	0	0	0	0	0	0	0
7/8/97	0	0	0	0	0	0	0	0	0	0
7/9/97	0	0	0	0	0	0	0	0	0	0
7/10/97	0	0	0	0	0	0	0	0	0	0
7/11/97	0	0	0	0	0	0	0	0	0	0
7/12/97	0	0	0	0	0	0	0	0	0	0
7/13/97	0	0	0	0	0	0	0	0	0	0
7/14/97	0	0	0	0	0	0	0	0	0	0
7/15/97	0	0	0	15	0	0	0	0	0	15
7/16/97	0	0	0	14	0	0	0	0	0	14
7/17/97	0	0	0	13	0	0	0	0	0	13
7/18/97	0	0	0	0	0	0	0	0	0	0
7/19/97	0	0	0	0	0	0	0	0	0	0
7/20/97	0	0	0	0	0	0	0	0	0	0
7/21/97	0	0	0	0	0	0	0	0	0	0
7/22/97	0	0	0	85	0	0	0	0	0	85
7/23/97	0	0	0	38	0	0	0	0	0	38
7/24/97	0	0	0	1	0	0	0	0	0	1
7/25/97	0	0	0	15	0	0	0	0	0	15
7/26/97	0	0	0	32	0	0	0	0	0	32
7/27/97	0	0	0	0	0	0	0	0	0	0

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
	0	0	17	3	3	0	0	0	1	24
	0	0	16	1	9	0	0	0	0	26
	0	0	12	6	10	0	0	0	0	28
	1	0	11	3	9	0	1	0	1	26
	0	0	15	4	14	0	0	0	5	38
	8	2	44	15	9	2	0	0	2	82
	3	0	30	11	9	1	0	0	0	54
	8	1	30	6	7	1	1	0	1	55
	5	0	15	4	5	0	0	0	2	31
	12	0	27	3	4	5	0	0	1	52
	1	0	19	7	1	0	0	0	1	29
	0	0	49	2	3	0	0	0	0	54
	0	0	12	7	0	0	0	0	1	20
	0	0	17	5	5	0	0	0	0	27
	1	0	17	9	1	0	0	0	2	30
	0	0	8	1	6	0	0	0	0	15
	0	0	8	7	1	0	0	0	0	16
	0	0	11	8	1	0	0	0	1	21
	0	0	16	3	3	0	0	0	1	23
	0	0	20	12	2	0	0	0	0	34
	0	0	44	14	6	0	0	1	0	65
	0	0	100	43	21	0	0	0	1	165
	0	0	50	22	7	0	0	0	1	80
	0	0	51	18	13	2	0	0	2	86
	0	0	27	21	6	0	0	0	0	54
	0	0	34	13	10	0	0	0	0	57
	0	0	16	1	1	0	0	1	1	20
	0	0	13	5	4	0	0	0	1	23
	0	0	30	10	5	0	0	1	0	46
	0	0	60	9	14	0	0	0	0	83
	0	0	69	10	12	0	0	2	0	93

Appendix A

Table 2: Daily bypass totals at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Date	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
7/28/97	0	0	0	8	0	0	0	0	0	8
7/29/97	0	0	0	0	0	0	0	0	0	0
7/30/97	0	0	0	30	0	0	0	0	0	30
7/31/97	0	0	0	12	0	0	0	0	0	12
8/1/97	0	0	0	11	0	0	0	0	0	11
8/2/97	0	0	0	11	0	0	0	0	0	11
8/3/97	0	0	0	16	0	0	0	0	0	16
8/4/97	0	0	0	26	0	0	0	0	0	26
8/5/97	0	0	0	13	0	0	0	0	0	13
8/6/97	0	0	0	8	0	0	0	0	0	8
8/7/97	0	0	0	8	0	0	0	0	0	8
8/8/97	0	0	0	8	0	0	0	0	0	8
8/9/97	0	0	0	0	0	0	0	0	0	0
8/10/97	0	0	0	0	0	0	0	0	0	0
8/11/97	0	0	0	0	0	0	0	0	0	0
8/12/97	0	0	0	0	0	0	0	0	0	0
8/13/97	0	0	0	0	0	0	0	0	0	0
8/14/97	0	0	0	0	0	0	0	0	0	0
8/15/97	0	0	1,031	241	152	16	0	0	0	1,440
8/16/97	0	0	0	0	0	0	0	0	0	0
8/17/97	0	0	0	0	0	0	0	0	0	0
8/18/97	0	0	0	0	0	0	0	0	0	0
8/19/97	0	0	0	0	0	0	0	0	0	0
8/20/97	0	0	0	0	0	0	0	0	0	0
8/21/97	0	0	0	0	0	0	0	0	0	0
8/22/97	0	0	0	0	0	0	0	0	0	0
8/23/97	0	0	0	0	0	0	0	0	0	0
8/24/97	0	0	0	0	0	0	0	0	0	0
8/25/97	0	0	0	0	0	0	0	0	0	0
8/26/97	0	0	0	0	0	0	0	0	0	0
8/27/97	0	0	0	0	0	0	0	0	0	0

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
0	0	46	3	13	0	0	1	0	63
0	0	16	3	2	0	0	1	0	22
0	0	24	11	6	0	0	0	0	41
0	0	19	5	1	0	0	0	0	25
0	0	11	1	1	0	0	0	1	14
0	0	7	1	0	0	0	0	0	8
0	0	13	6	6	0	0	0	0	25
0	0	4	2	1	0	0	0	0	7
0	0	21	2	2	0	0	0	0	25
0	0	7	1	0	0	0	0	0	8
0	0	5	3	4	0	0	1	0	13
0	0	2	0	1	0	0	0	0	3
0	0	9	1	1	0	0	0	0	11
0	0	5	1	1	0	0	0	0	7
0	0	21	2	1	0	0	0	0	24
0	0	5	0	1	0	0	0	0	6
0	0	17	3	5	0	0	0	0	25
0	0	3	2	0	0	0	0	0	5
0	0	10	5	0	0	0	0	0	15
0	0	9	2	5	0	0	0	0	16
0	0	17	0	0	0	0	0	0	17
0	0	12	1	1	0	0	0	0	14
0	0	1	1	0	0	0	0	0	2
0	0	2	0	0	0	0	0	0	2
0	0	21	6	1	0	0	0	0	28
0	0	6	2	1	0	0	0	0	9
0	0	6	0	0	0	0	0	0	6
0	0	20	6	1	0	0	0	0	27
0	0	12	0	0	0	0	0	0	12
0	0	22	3	1	0	0	0	0	26
0	0	17	2	2	1	0	0	1	23

Appendix A

Table 2: Daily bypass totals at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Date	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
8/28/97	0	0	0	0	0	0	0	0	0	0
8/29/97	0	0	0	0	0	0	0	0	0	0
8/30/97	0	0	0	0	0	0	0	0	0	0
8/31/97	0	0	0	0	0	0	0	0	0	0
9/1/97	0	0	0	0	0	0	0	0	0	0
9/2/97	0	0	0	0	0	0	0	0	0	0
9/3/97	0	0	0	0	13	1	0	0	0	14
9/4/97	0	0	0	0	7	3	0	0	0	10
9/5/97	0	0	0	0	9	5	0	0	0	14
9/6/97	0	0	0	0	17	4	0	0	0	21
9/7/97	0	0	0	0	5	1	0	0	0	6
9/8/97	0	0	0	0	6	0	0	0	0	6
9/9/97	0	0	0	0	4	4	0	0	0	8
9/10/97	0	0	0	0	1	0	0	0	0	1
9/11/97	0	0	0	1	6	1	0	0	0	8
9/12/97	0	0	0	0	6	0	0	0	0	6
9/13/97	0	0	0	0	4	0	0	0	0	4
9/14/97	0	0	0	0	2	0	0	0	0	2
9/15/97	0	0	0	0	6	0	0	0	0	6
9/16/97	0	0	0	0	3	0	0	0	0	3
9/17/97	0	0	0	0	2	1	0	0	0	3
9/18/97	0	0	0	0	3	1	0	0	0	4
9/19/97	0	0	0	0	7	0	0	0	0	7
9/20/97	0	0	0	0	7	1	0	0	0	8
9/21/97	0	0	0	0	7	4	0	0	0	11
9/22/97	0	0	0	0	3	0	0	0	0	3
9/23/97	0	0	0	0	3	0	0	0	0	3
9/24/97	0	0	0	0	0	2	0	0	0	2
9/25/97	0	0	0	0	1	5	0	0	0	6
9/26/97	0	0	0	0	2	2	0	0	0	4
9/27/97	0	0	0	0	5	4	0	0	0	9

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
	0	0	7	2	0	0	0	0	1	10
	0	0	5	4	2	0	0	0	0	11
	0	0	7	0	0	0	0	0	1	8
	0	0	13	1	0	0	0	0	0	14
	0	0	2	2	0	0	0	0	1	5
	0	0	8	4	1	0	0	0	0	13
	0	0	8	3	0	0	0	0	0	11
	0	0	12	2	1	0	0	0	0	15
	0	0	19	5	0	0	0	0	0	24
	0	0	14	13	1	0	0	0	0	28
	0	0	15	5	1	0	0	0	2	23
	0	0	15	12	1	0	0	0	0	28
	0	0	10	5	0	0	0	0	0	15
	0	0	13	6	1	0	0	0	1	21
	0	0	6	10	0	0	0	0	0	16
	0	0	8	4	0	0	0	0	0	12
	0	0	5	2	0	0	0	0	1	8
	0	0	8	4	0	0	0	1	0	13
	0	0	5	5	0	0	0	0	0	10
	0	0	3	2	0	0	0	0	1	6
	0	0	5	9	0	0	0	0	0	14
	0	0	3	6	0	0	0	0	0	9
	0	0	9	9	0	0	0	0	0	18
	0	0	4	9	0	0	0	0	0	13
	0	0	9	19	0	0	0	0	0	28
	0	0	3	3	0	0	0	0	0	6
	0	0	5	15	0	0	0	0	0	20
	0	0	2	1	1	0	0	0	0	4
	0	0	2	1	1	1	0	0	0	5
	0	0	28	45	0	0	0	1	1	75
	0	0	1	4	0	0	0	0	0	5

Appendix A

Table 2: Daily bypass totals at LGR, 1997

Date	Yearling Chinook Hatch	Yearling Chinook Wild	Subyearling Chinook Hatch	Subyearling Chinook Wild	Steelhead Hatch	Steelhead Wild	Coho Hatch	Sock/Kok Hatch	Sock/Kok Wild	Daily Total
9/28/97	0	0	0	0	2	8	0	0	0	10
9/29/97	0	0	0	0	2	0	0	0	0	2
9/30/97	0	0	0	0	2	1	0	0	0	3
10/1/97	0	0	0	0	1	1	0	0	0	2
10/2/97	0	0	0	0	0	0	0	0	0	0
10/3/97	0	0	0	0	0	0	0	0	0	0
10/4/97	0	0	0	0	0	0	0	0	0	0
10/5/97	0	0	0	0	0	1	0	0	0	1
10/6/97	0	0	0	0	0	1	0	0	0	1
10/7/97	0	0	0	0	0	0	0	0	0	0
10/8/97	0	0	0	0	1	1	0	0	0	2
10/9/97	0	0	0	0	1	1	0	0	0	2
10/10/97	0	0	0	0	0	0	0	0	0	0
10/11/97	0	0	0	0	1	0	0	0	0	1
10/12/97	0	0	0	0	0	0	0	0	0	0
10/13/97	0	0	0	0	1	0	0	0	0	1
10/14/97	0	0	0	0	3	0	0	0	0	3
10/15/97	0	0	0	0	0	0	0	0	0	0
10/16/97	0	0	0	0	0	0	0	0	0	0
10/17/97	0	0	0	0	0	0	0	0	0	0
10/18/97	0	0	0	0	1	0	0	0	0	1
10/19/97	0	0	0	0	2	0	0	0	0	2
10/20/97	0	0	0	0	1	2	0	0	0	3
10/21/97	0	0	0	0	1	1	0	0	0	2
10/22/97	0	0	0	0	0	1	0	0	0	1
10/23/97	0	0	0	0	1	1	0	0	0	2
10/24/97	0	0	0	0	0	0	0	0	0	0
10/25/97	0	0	0	0	1	1	0	0	0	2
10/26/97	0	0	0	0	0	1	0	0	0	1
10/27/97	0	0	0	0	0	0	0	0	0	0
10/28/97	0	0	0	0	0	1	0	0	0	1

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

Date	Yearling Chinook Hatch	Yearling Chinook Wild	Subyearling Chinook Hatch	Subyearling Chinook Wild	Steelhead Hatch	Steelhead Wild	Coho Hatch	Sock/Kok Hatch	Sock/Kok Wild	Daily Total
9/28/97	0	0	1	3	0	1	0	0	0	5
9/29/97	0	0	2	5	0	1	0	1	1	10
9/30/97	0	0	2	3	0	0	0	1	0	6
10/1/97	0	0	2	2	0	0	0	0	0	4
10/2/97	0	0	0	1	0	0	0	0	0	1
10/3/97	0	0	0	2	0	0	0	0	0	2
10/4/97	0	0	1	1	0	0	0	0	0	2
10/5/97	0	0	1	0	0	0	0	0	0	1
10/6/97	0	0	2	0	1	0	0	0	0	3
10/7/97	0	0	0	0	0	0	0	0	0	0
10/8/97	0	0	0	0	0	0	0	0	0	0
10/9/97	0	0	0	0	0	0	0	0	0	0
10/10/97	0	0	0	0	0	0	0	0	0	0
10/11/97	0	0	0	0	0	0	0	0	0	0
10/12/97	0	0	0	0	0	0	0	0	0	0
10/13/97	0	0	0	0	0	0	0	0	0	0
10/14/97	0	0	0	0	1	0	0	0	0	1
10/15/97	0	0	0	0	0	0	0	0	0	0
10/16/97	0	0	0	0	0	0	0	0	0	0
10/17/97	0	0	1	0	0	0	0	0	0	1
10/18/97	0	0	0	0	0	0	0	0	0	0
10/19/97	0	0	1	2	0	0	0	0	0	3
10/20/97	0	0	0	0	0	0	0	0	0	0
10/21/97	0	0	0	0	0	0	0	0	0	0
10/22/97	0	0	0	0	0	0	0	0	0	0
10/23/97	0	0	1	0	0	0	0	0	0	1
10/24/97	0	0	1	0	0	0	0	0	0	1
10/25/97	0	0	0	0	0	0	0	0	0	0
10/26/97	0	0	0	0	0	0	0	0	0	0
10/27/97	0	0	1	0	0	0	0	0	0	1
10/28/97	0	0	0	0	0	0	0	0	0	0

Appendix A

Table 2: Daily bypass totals at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
Date	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
10/29/97	0	0	0	0	2	0	0	0	0	2
10/30/97	0	0	0	0	0	0	0	0	0	0
10/31/97	0	0	0	0	0	1	0	0	0	1
11/1/97	0	0	0	0	2	1	0	0	0	3
	407	787	1,031	617	110,753	2,941	29	0	0	116,565

Table 3: Daily facility (raceway and sample) mortality at LGR, 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sock/Kok		Daily
	Hatch	Wild	Hatch	Wild	Hatch	Wild	Hatch	Hatch	Wild	Total
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0
	2,004	412	1,613	620	3,170	157	2	12	116	8,106

Appendix A

Table 4: Final disposition of salmonids collected at LGR in 1997

	Yearling Chinook		Subyearling Chinook		Steelhead		Coho	Sockeye/Kokanee		
TOTAL	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Hatchery	Wild	Total
Collected	224,847	56,978	73,437	17,473	4,022,510	300,215	1,517	411	2,937	4,700,325
Total Transported	222,342	55,779	70,793	16,219	3,908,523	297,053	1,486	399	2,821	4,575,415
Barged	219,683	52,679	0	998	3,774,369	276,520	1,066	0	2,022	4,327,337
Trucked	2,659	3,100	70,793	15,221	134,154	20,533	420	399	799	248,078
Bypassed	407	787	1,031	617	110,753	2,941	29	0	0	116,565
Sampled	2,975	951	19,746	6,700	59,587	4,919	107	149	204	95,338
Total Mortality	2,098	412	1,613	637	3,234	221	2	12	116	8,345
Facility Mortality	1,930	382	845	241	2,925	135	0	2	74	6,534
Sample Mortality	74	30	768	379	245	22	2	10	42	1,572
Research Mortality	94	0	0	17	64	64	0	0	0	239